5th Annual CMMI Technology Conference and User Group

Denver, CO

14-17 November 2005

Agenda

Monday, 14 November 2005

Tutorial Tracks

Track 1:

- Calculating CMMI-Based Return on Investment (ROI): Why, When, What, How?, Mr. Rolf W. Reitzig, Cognece, Inc.
- A Practical Guide to Implementing Levels 4 and 5, Mr. Rick Hefner, Northrop Grumman Corporation

Track 2:

- Agile/Lean Workshop, Mr. Jeffrey Dutton, Jacobs Sverdrup
- Mr. Tim Kasse, Kasse Initiatives, LLC:
  1. Leveraging ITIL Services (Suppport and Delivery) Capability and Maturity with the CMMI
  2. Service Management “A Process Led Approach”
  3. ITIL IT Infrastructure Library Overview
  4. Overview of Service Support & Service Delivery Functions
  5. Configuration Management & Change Management
  6. “Service Support” Change Management
  7. “Service Support” Configuration Management
  8. Configuration Management & Change Management ITIL - CMMI
  9. ITIL Process Maturity Self-Assessment & Action Plan

Track 3:

- The Look and Feel of a Successful CMMI Implementaiton, Mr. Tim Kasse, Kasse Initiatives, LLC
- How to Define CMMI Based Process That are Short and Usable and Using a Process Measurement Framework to Successfully Achieve Measurable Results, Mr. Timothy G. Olson, Quality Improvement Consultatnts, Inc.

Track 4:

- Using Simulation to Support Better Management Decisions, Dr. David M. Raffo, Portland State University
- Institutionalizing Resource Planning and Management Part I and Part II, Mr. Donald A. Borcherding, NexSummit, LLC

Track 5:

- The CMMI V1.2 ... A Tutorial, Mr. David M. Phillips, SEI

Track 6:

- Integrated Porject Management (IPM) - The CMMI and Collaborative Product Develop and Requirement Engineering: A Practicial Approach to Modeling and Managing Requirements, Mr. William J. Deibler, II Software Systems Quality Consulting - SSQC

Tuesday, 15 November 2005

General Sessions

LTG Joseph Yakovac, USA, Miliatry Deputy Office of the Secretary of the Army, Acquisition, Logistics & Technology

Executive Panel: "How Has CMMI Improved Our Program & Project Performance -- Or Has It?":

- Mr. Mark Schaeffer, Director, Systems Engineering, OUSD(AT&L) Defense System and OSD Sponsor, CMMI
- Mr. Dev Banerjee, Division Director, Systems & Flight Engineering, Boeing Integrated Defense Systems
- Mr. John Evers, Raytheon Processes Program Manager, Raytheon Common Engineering Process Program
- Brig Gen Gary Salisbury, USAF (Ret), Executive Director Business Development, Defense Mission Systems, Northrop Grumman Mission Systems

Lunch: CMMI State of the Model, Mr. Bob Rassa, Raytheon; Mr. Clyde Chittister, SEI

Technical Sessions

Track 1: CMMI Process Improvement

- CMMI/ISO - "Can't we all just get along?", Mr. Dale R. Spaulding, The Boeing Company
- Real World Application of IEEE Software Engineering Standards to CMM/CMMI Software Process Improvement Initiatives, Ms. Susan K. Land, Norhtrop Gurmman IT/TASC
- The CMMI Product Suite and International Standards -- An Update, Mr. David H. Kitson, SEI

Track 2: Practical Guidance

- Verification in CMMI using Peer Reviews - Presentation and Paper, Ms. Jeanne H. Balsam, Georgia Tech Research Institute
- Process QA in the Information Age: Keep it Light!, Hillel Glazer, Entinex, Inc
- Defect Datat and Configuation Management, Ms. Julie E. Schmarje, Raytheon Company

Track 3: Appraisals

- Wasted Days and Wasted Nights - Leveraging Your Appraisal Team as a Resource, Dr. Timothy J. Davis, Raytheon Missile Systems
- Building a Credible SCAMPI Appraisal Representative Sample, Mr. Robert L. Moore, III., Business Transformation Institute, Inc.
- Top 10 Signs You're Ready (or Not) for an Appraisal, Mr. Gary Natwick, Harris Corporation

Track 4: ROI & Benefits of CMMI

- Measuring Performance: Evidence About the Results of CMMI, Ms. Diane Gibson, SEI
- Prioritizing Process Improvement Strategies in CMMI to Optimize Business Objectives, Dr. Aldo Dagnino, ABB, Inc. US Corporate Research
- Implementing a Plan for Controlling ROI for CMMI Process Improvement, Mr. J. M. Perry, BAE Systems
- Lessons Learned in the Engineering of Process Performance Models on the Journey to Higher Maturity Levels, Mr. Dr. Mary Anne Herndon, SAIC

Track 5: Acquisition / High Maturity

- Getting Lost on the Way to Level 5, Ms. Kathy King, The Center for Systems Management
- Understanding Why?, Mr. David N. Card, Q-Labs

Track 6: Transitioning to CMMI

- Migrating Best Practices Within an Organization: Experiences in Adapting CMMI Policies and Procedures Used in One Part of a Business to Another, Mr. Scott Sherrill, Georgia Tech Research Institute
- An Enterprise Wide CMMI Implementation at Accenture, Ms. Sarah S. Bengzon, Accenture
- Stakeholder Identification and Involvement in the CMMI, Mr. James R. Armstrong, Systems and Software Consortium
- Ensuring the Right Process is Deployed Right: Synchronizing Process Checkpoints with Business Rhythm, Ms. Joan Weszka, Lockheed Martin Corporation

Track 7: CMMI for Small Projects anhd Organizations

- Making PPQA Work on Small Projects Presentation and Paper, Ms. Jean M. Swank, Georgia Tech Research Institute
- Does Size Matter in CMMI Implementation or Was Yoda Wrong?, Mr. Paul H. Meyers, SAIC

Wednesday, 16 November 2005

Technical Sessions

Track 1: CMMI Process Improvement

- A Change Agent in a Level 1 Organization; How to Survive in a Hostile Environment, Mr. Andrew Cordes, ABB - United States Corporate Research Center
- "Sound Systems Engineering Using CMMI, Mr. Michael T. Kutch, Jr., SPAWAR - Charleston
- Using CMMI to "Dig Out" from an Ad Hoc Development?, Mr. Donald A. Borcherding, NexSummit, LLC
- Strategic Planning: Selling a CMMI-Based Improvement Effort to Senior Management, Dr. Aldo Dagnino, ABB, Inc., US Corporate Research
- Enterprise Process Intergration within the Space and Airborne Systems Business Area of Raytheon, Mrs. Deana A. Seigler, Raytheon Company
- Interpreting the CMMI: It Depends!, Mr. Rick Hefner, Northrop Grumman Corporation
- CMMI as Safeguard Against Software Entropy: A Manager's Perspective, Dr. Thomas F. Christian, Jr., 402 SMXG
- "Its how big? How will you deploy it without killing my team and my program?", Mr. William Borkowski, Jr., Raytheon Missile Systems

Track 2: Practical Guidance

- Are You Making the Most of Your Project Schedules?, Ms. Susan Byrnes, PMP, Natural SPI, Inc.

- Keeping the Team Motivated for Success and "Barrier Busting" – Obtaining Active Leadership Support, Mr. Michael D. Scott, Raytheon Missile Systems
- Using a Level 3 Process to Achieve CMMI Level 3, Mr. Stephen Ross, Raytheon Company
- Accelerating Process Improvement through Collaboratio: The NAVAIR Systems Process Improvement Community of Practice, Ms. Katie Smith, Naval Air Systems Command
- What the CMMI Doesn't Say About Training (But Should!), Sree Yellayi, Siemens Corporate Research
- CMMI CP 2.8 Interpretation and Implementation: Is This Practice Just About Numbers?, Mr. Lester Stamnas, Norausky Process Solutions, Inc.
- Creating Helpful process Directives, Mr. Kenneth I. Weinberg, Raytheon Company

Track 3: Appraisals

- Lessions Learned in Helping Large and Small Organizations Prepare for their First Appraisal, Mr. Robert J. Pomietto, Center for Systems Management
- Behind Closed Doors, Mr. Tom G. Lienhard, Raytheon Missile Systems
- CMMI Appraisal Results: The Shocking Truth Revealed and Lead Appraisers Gone Wild, Ms. Margaret A. Glover, SEI
- Improving Document Reviews for Appraisals, Mr. Kent McClurg, Raytheon Company
- Finding CMMI Compliant Artifacts and a Needle in a Haystack, Adrio J. DeCicco, Raytheon Company
- Lessons Learned and Best Practices for Evidence Collection in Preparation for a SCAMPI Appraisal, Mr. Ben Berauer, Raytheon Company
- Maximizing Value for SCAMPI(SM) Preparation, Ms. Joan Weszka, Lockheed Martin Corporation

Track 4: ROI & Benefits of CMMI

- Evaluating the Impact New Tools and Technologies Using Simulation, Dr. David M. Raffo, Portland State University
- The ROI Dashbord (c): Understanding the Benefits of CMMI, Mr. Thomas L. McGibbon, ITT Industries, AES
- Quality Assurance Involvement Compared to Program Results, Ms. Jill Brooks, Raytheon Company
- Rapidly Achieving Measurable ROI Using Early Defect Detection, Mr. Timothy G. Olson, Quality Improvement Consultants, Inc
- CMMI Process Improvement: Its not a technical problem, its a people problem, Mr. Rolf W. Reitzig, Cognence, Inc.
- A Project's Perspective of a CMMI Level 5, Mr. Warren Scheinin, Northrop Grumman Corporation
- Achieving the Promised Benefits of CMMI, Dr. Rick Hefner, Norhtrop Grumman Corporation
- Measuring Economic Benefits of Process Improvement in CMMI Level 1 Organization, Dr. Aldo Dagnino, ABB, Inc., US Corporate Research

Track 5: High Maturity

- Logarithms Can Be Your Friends: Controlling Peer Review Cost?, Dr. Richard L. W. Welch, Northrop Grumman Corporation
- Journeys on the Road to Level 5, Mr. Joseph V. Vanderville, Northrop Grumman Corporation
- Lessons Learned on the SCAMPI Road to CMMI-Software Level 5, Mr. Joseph N. Frisina, BAE Systems
- Merging Measurement in Mature Companies - A Success Story of Measurement Process Integration, Ms. Sharon Rohde, Lockheed Martin IS&S
- The Road to Process Improvement Successes: CMMI Level 5/ISO 9001-2000 Business Model, Mrs. Debra S. Roy, BAE Systems, National Security Solutions
- Reducing Variation at Each CMMI Maturity Level?, Mr. Timothy Kasse, Kasse Initiatives, LLC
- Ways to Ensure the Culture Supports Level 5, Mr. Warren Scheinin, Northrop Grumman Corporation
- Analyzing Defects Can Tell a Story About a Company?, Ms. Diane A. Mitzukami-Williams, Northrop Grumman Corporation Mission Systems

Track 6: Transition to CMMI

- Combining Six IPTS and Transitioning to CMMI, Ms. Judy Overhouser-Duett, NAVAIR
- How to Transition Models and Disciplines - Looking for Transition in all the Wrong Places, Ms. Lori G. Smailes, TYBRIN Corporation
- Using SW-SMM SQA Independent Verificaiton as a First Step for the Transition to CMMI, Mr. Alfredo N. Tsukumo, CenPRA-Centro de Pesquisas Renato Archer
- Service Extensions to the CMMI, Mr. Craig R. Hollenbach, Northrop Grumman Corporation
- Applying CMMI to Services, Mr. Juan C. Ceva, Raytheon ITSS
- Management Challenges & Lessons Learned Implementing CMMI in a Services Environment, Mr. Thomas E. Zience, BAE Systems Information Technology
- CMMI v1.1 for a Service Oriented Organization, Mr. Steven K. Hall, Raytheon Corporation

Track 7: Measurement

- Software Size Growth and Uncertainity - Both Affect Estimate Quality and Project Risk Presentation and Paper, Mr. Michael A. Ross, Galorath, Inc.
- Building an Automated System to Support Measurement in CMMI, Dr. Richard Hayden, Pragma Systems Corporation
- Team of Three - How to Get Program, Functional and Process Management Working Together, Mr. Mark A. Marsh, Raytheon Company
- Parametric Project Monitoring and Control: Performance-Based Progress Assessment and Prediction Presentation and Paper, Mr. Michael A. Ross, Galorath, Inc.
- Measuring and Estimating Process Performance, Dr. Richard D. Stutzke, SAIC

Thursday, 17 November 2005

Technical Sessions

Track 1: CMMI Process Improvement

- "Barrier Busting" – Obtaining Active Leadership Support, Mr. Michael D. Scott, Raytheon
- Don't Write the Wrong Processes!, Ms. Suzanne B. Zampella, The Center for Systems Management

- Contrasting CMMI Contrasting CMMI and the PMBOK, Mr. Wayne Sherer, Anteon Corporation
- Being Customer Oriented, Mr. Tim Kasse, Kasse Initiatives, LLC
- Learning from Lessons Observed - Mitigating Resistance to Process Improvement, Mr. Bob Norris, National Geospatial-Intelligence Agency

Track 2: Practical Guidance

- Supplier Management Strategy Considerations with CMMI, Mr. Rick Hefner, Northrop Grumman Corporation
- Simplifying Process Tailoring To Enhance Project Execution, Mr. Howard T. Kaplan, Raytheon Company
- CMMI and agile: a High Tech R&D Success Story, Mr. Gene Miluk, SEI
- How to Incorporate “Lessons Learned” for Sustained Process Improvements, Mr. Anil K. Midha, BAE Systems
- Data Management: The Hidden Enabler or (The Key Data and Work Product Integrator), Mr. Lester Stamnas, Norausky Process Solutions

Track 3: Appraisals

- Techniques for Shortening the Time and Cost of CMMI Appraisals, Mr. Sam Fogle, Systems and Software Consortium, Inc.
- Using Classified Programs in CMMI Appraisals, Mr. Kenneth I. Weinberg, Raytheon Company
- The Best Intentions of SCAMPI V1.1: What We Meant and What Some People Heard, Mr. Will Hayes, SEI
- A Quantitative Comparison of SCAMPI A, B, and C, Mr. Dan Luttrell, Northrop Grumman Mission Systems
- Performing Consistent Appraisals in a Global Organization, Ms. Jeanine Courtney-Clark, Integrated System Diagnostics, Inc

Track 4: ROI & Benefits of CMM I / SCAMPI B/C

- The Effects of CMMI on Program Performance, Mr. Joseph P. Elm, SEI
- Squeezing Variation for Profit, Mr. Donald R. Corpron, Northrop Grumman Corporation
- Process In Execution Review (PIER) and the SCAMPI B Method, Ms. Lorraine J. Adams, SEI
- Planning a SCAMPI C Appraisal from a Strategic Perspective, Mr. John P. Kennedy, The Mitre Corporation
- Critical Path SCAMPISM Getting Real Business Results from Appraisals, Mr. Michael J. West, Natural SPI, Inc.
- Using SCAMPI C for Collective Improvement Across a Multi-Business Program, Mr. Oktawian Nowak, Motorola, Inc.

Track 5: High Maturity

- A Statistical Approach to Product Quality Assurance, mr. Randall J. Varga, BAE Systems
- The Key to a High Maturity Rating is - ORGANIZATION, Mrs. Karen M. Pelletier, Northrop Grumman Corporation
- Paladin Drives Forward To CMMI® Maturity Level 5, Mr. Victor Elias, M.S., Armament Software Engineering Center, US Army
- Business Improvements Achieving CMMI®Level 5 at SAIC: Who Keeps Moving My Process?, Ms. Sharon Cobb Flanagan, SAIC
- Extending CMMI Level 4/5 Organization Metrics Beyond Software Development, Ms. Linda R. Brooks, Northrop Grumman Corporation

Track 6: CMMI Extensions

- Capability Maturity Model Integration (CMMI®) Tailoring for an IT/MS Services Environment, Ms. Stacy Savage, BAE Systems Information Technology
- Adapting CMMI for Acquisition Organizations: A Preliminary Report, Dr. Hubert Hofmann, General Motors
- How to Become Your Customer’s Software Provider of Choice, Mr. David Herron, DCG, Inc.
- Space and Missile Systems CenteSpace and Missile Systems Center, Mr. Keith Wright, SPARTA, Inc.
- Software Outsourcing with CMMI, Dr. John W. Mishler, SEI

Track 7: Systems Engineering

- Sound Systems Engineering using CMMI®, Ms. Sandee D. Guidry, TECHSOFT
- Systems Engineering Influence Throughout the CMMI, Mr. Tim Kasse, Kasse Initiatives, LLC
- Future of System and Software Engineering Project Management and the CMMI, Dr. Kenneth E. Nidiffer, Systems and Software Consortium

NATIONAL DEFENSE INDUSTRIAL ASSOCIATION
STRENGTH THROUGH INDUSTRY & TECHNOLOGY

5th Annual

CMMI® Technology Conference and User Group

Conference Agenda

Sponsored by:

The National Defense Industrial Association

Systems Engineering Division

in conjunction with the

Software Engineering Institute,

Carnegie Mellon University

Carnegie Mellon
Software Engineering Institute

Event # 6110
November 14 - 17, 2005
Hyatt Regency Tech Center
Denver, CO

Sunday, November 13, 2005

12:00 PM - 4:00 PM
Registration for Conference and Tutorial — Atrium

Monday, November 14, 2005

7:00 AM - 5:00 PM — Atrium
Tutorial Registration ($200 Tutorial Fee)

7:00 AM - 8:00 AM — Atrium
Continental Breakfast (Tutorial Attendees Only)

8:00 AM - 5:00 PM — See Following Pages
CMMI Tutorial Tracks (Tutorial Attendees Only)

12:00 PM - 1:00 PM — Grand Mesa ABC
Lunch (Tutorial Attendees Only)

5:00 PM - 6:30 PM — Display Area
Reception **(All CMMI Conference Attendees)**

Tuesday, November 15, 2005

7:30 AM - 8:30 AM — Atrium
Registration and Continental Breakfast

8:30 AM - 8:45 AM — Grand Mesa DEF
Opening Remarks

8:45 AM - 9:30 AM — Grand Mesa DEF
Session A
LTG Joseph Yakovac, USA, Military Deputy, Office of the Secretary of the Army, Acquisition, Logistics & Technology

9:30 AM - 10:00 AM — Atrium
Break

10:00 AM - 12:00 PM — Grand Mesa DEF
Session B
Executive Panel - “How Has CMMI Improved Our Program & Project Performance - Or Has it?”
Moderator:
Mr. Mark Schaeffer, Director, Systems Engineering, OUSD(AT&L) Defense Systems and OSD Sponsor, CMMI

Panelists:
Mr. Dev Banerjee, Division Director, Systems & Flight Engineering, Boeing Integrated Defense Systems
Mr. John Evers, Raytheon Processes Program Manager, Raytheon Common Engineering Process Program
Brig Gen Gary Salisbury, USAF (Ret), Executive Director, Business Development, Defense Mission Systems, Northrop Grumman Mission Systems

12:00 PM - 1:30 PM — Grand Mesa ABC
Lunch
CMMI - State of the Model
Mr. Bob Rassa, Raytheon; ***Mr. Clyde Chittister***, SEI

1:30 PM - 5:00 PM
Technical Sessions — See Following Pages

3:00 PM - 3:30 PM — Display Area
Break

5:00 PM - 6:30 PM — Display Area
Reception

Wednesday, November 16, 2005

7:00 AM - 8:00 AM — Atrium
Registration and Continental Breakfast

8:00 AM - 5:00 PM — See Following Pages
Technical Sessions

9:30 AM - 10:30 AM — Display Area
Break

12:00 PM - 1:30 PM — Grand Mesa ABC
Lunch
Conference Best Paper Awards

3:00 PM - 3:30 PM — Display Area
Break

Thursday, November 17, 2005

7:00 AM - 8:00 AM — Atrium
Registration and Continental Breakfast

8:00 AM - 2:30 PM — See Following Pages
Technical Sessions

9:30 AM - 10:30 AM — Display Area
Break

12:00 PM - 1:00 PM — Grand Mesa ABC
Lunch

2:30 PM
Conference Adjourns

CMMI Tutorial Tracks - Monday, November 14, 2005

	Session A		Session B		Session C		Session D	
	8:00 AM		10:15 AM		1:00 PM		3 :15 PM	
Track 1 Grand Mesa D/E	*1A1 Calculating CMMI-based Return On Investment (ROI): Why, When, What, How? Mr. Rolf W. Reitzig, Cognence, Inc.*	BREAK (9:45 AM) (TUTORIAL ATTENDEES ONLY)	*1B1 Calculating CMMI-based Return On Investment (ROI): Why, When, What, How? (con't.) Mr. Rolf W. Reitzig, Cognence, Inc.*	LUNCH (12:00 PM) (TUTORIAL ATTENDEES ONLY)	*1C1 A Practical Guide to Implementing Levels 4 and 5 Dr. Rick Hefner, Northrop Grumman Corporation*	BREAK (2:45 PM) (TUTORIAL ATTENDEES ONLY)	*1D1 A Practical Guide to Implementing Levels 4 and 5 (con't.) Dr. Rick Hefner, Northrop Grumman Corporation*	RECEPTION IN DISPLAY AREA (5:00 PM) (ALL ATTENDEES)
Track 2 Grand Mesa F	*1A2 Agile/Lean Workshop Mr. Jeffrey Dutton, Jacobs Sverdrup*		*1B2 Agile/Lean Workshop (con't.) Mr. Jeffrey Dutton, Jacobs Sverdrup*		*1C2 Leveraging ITIL Services (Support and Delivery) Capability and Maturity with the CMMI Mr. Tim Kasse, Kasse Initiatives, LLC*		*1D2 Leveraging ITIL Services (Support and Delivery) Capability and Maturity with the CMMI (con't.) Mr. Tim Kasse, Kasse Initiatives, LLC*	
Track 3 Highlands	*1A3 The Look and Feel of a Successful CMMI Implementation Mr. Tim Kasse, Kasse Initiatives, LLC*		*1B3 The Look and Feel of a Successful CMMI Implementation (con't.) Mr. Tim Kasse, Kasse Initiatives, LLC*		*1C3 How to Define CMMI Based Processes That are Short and Usable Mr. Timothy G. Olson, Quality Improvement Consultants, Inc.*		*1D3 How to Define CMMI Based Processes That are Short and Usable (con't.) Mr. Timothy G. Olson, Quality Improvement Consultants, Inc.*	
Track 4 Chasm Creek	*1A4 The ROI of CMMI: Using Process Simulation to Support Better Management Decisions Dr. David M. Raffo, Portland State University*		*1B4 The ROI of CMMI: Using Process Simulation to Support Better Management Decisions (con't.) Dr. David M. Raffo, Portland State University*		*1C4 Institutionalizing Resource Planning and Management Mr. Donald A. Borcherding, NexSummit LLC*		*1D4 Institutionalizing Resource Planning and Management (con't.) Mr. Donald A. Borcherding, NexSummit LLC*	
Track 5 Mesa Verde	*1A5 Using a Measurement Framework to Successfully Achieve Measurable Results Mr. Timothy G. Olson, Quality Improvement Consultants, Inc.*		*1B5 Using a Measurement Framework to Successfully Achieve Measurable Results (con't.) Mr. Timothy G. Olson, Quality Improvement Consultants, Inc.*		*1C5 The CMMI V1.2 – An Update Mr. Mike Phillips, SEI*		*1D5 The CMMI V1.2 – An Update (con't.) Mr. Mike Phillips, SEI*	
Track 6 Wind River	*1A6 Integrated Project Management (IPM) – The CMMI and Collaborative Product Development Mr. William J. Deibler, II, Software Systems Quality Consulting - SSQC*		*1B6 Integrated Project Management (IPM) – The CMMI and Collaborative Product Development (con't) Mr. William J. Deibler, II, Software Systems Quality Consulting - SSQC*		*1C6 Requirements Engineering: A Practical Approach to Modeling and Managing Requirements Mr. William J. Deibler, II, Software Systems Quality Consulting - SSQC*		*1D6 Requirements Engineering: A Practical Approach to Modeling and Managing Requirements (con't) Mr. William J. Deibler, II, Software Systems Quality Consulting - SSQC*	

CMMI Technical Tracks - Tuesday, November 15, 2005

Track	Session/Chair	Session C 1:30 PM	Session C 2:15 PM		Session/Chair	Session D 3:30 PM	Session D 4:15 PM	
Track 1 Grand Mesa D/E	***CMMI and Process Improvement*** **Mr. Brian Gallagher, SEI**	2C1 CMMI / ISO - "Can't we all just get along?" ***Mr. Dale R. Spaulding***, The Boeing Company	2C1 Layering CMMI over ISO 9000 and BS 7799: A Case Study in Improvement ***Mr. Edwin B. Smith, III***, Hart InterCivic	**BREAK IN DISPLAY AREA (3:00 PM - 3:30 PM)**	***CMMI and Process Improvement con't.***	2D1 Real World Application of IEEE Software Engineering Standards to CMM® /CMMI® Software Process Improvement Initiatives ***Mr. Susan K. Land***, Northrop Grumman IT/TASC	2D1 The CMMI Product Suite and International Standards – an Update ***Mr. David H. Kitson***, SEI	**RECEPTION IN DISPLAY AREA (5:00 PM - 6:30 PM)**
Track 2 Grand Mesa F	***Practical Guidance*** **Mr. Fred Schenker, SEI**	2C2 Verification in CMMI using Peer Reviews ***Ms. Jeanne H. Balsam***, Georgia Tech Research Institute	2C2 Process QA in the Information Age: Keep it Light! ***Mr. Hillel Glazer***, Entinex, Inc.		***Practical Guidance con't.***	2D2 Defect Data and Configuration Management ***Ms. Julie E. Schmarje,*** Raytheon Company	2D2 Cancel	
Track 3 Highlands	***Appraisals*** **Mr. Geoff Draper, Harris Corporation**	2C3 SEI Quality Assurance Activities for CMMI Appraisals ***Mr. Will Hayes***, Software Engineering Institute	2C3 Wasted Days and Wasted Nights - Leveraging Your Appraisal Team As A Resource ***Mr. Timothy J. Davis***, Raytheon Missile Systems		***Appraisals con't.***	2D3 Building a Credible SCAMPI Appraisal Representative Sample ***Mr. Robert L. Moore, III***, Business Transformation Institute, Inc.	2D3 Top 10 Signs You're Ready (or Not) for an Appraisal ***Mr. Gary Natwick***, Harris Corporation	
Track 4 Chasm Creek	***ROI & Benefits of CMMI*** **Ms. Diane Gibson SEI**	2C4 Measuring Performance: Evidence about the Results of CMMI® ***Ms. Diane Gibson***, SEI	2C4 Prioritizing Process Improvement Strategies in CMMI to Optimize Business Objectives ***Dr. Aldo Dagnino***, ABB, Inc. US Corporate Research		***ROI & Benefits of CMMI con't.***	2D4 Implementing a Plan for Controlling ROI for CMMI® Process Improvement ***Mr. J. M. Perry***, BAE Systems	2D4 Lessons Learned in the Engineering of Process Performance Models on the Journey to Higher Maturity Levels ***Dr. Mary Anne Herndon***, Transdyne Corporation	
Track 5 Mesa Verde	***Acquisition*** **Mr. Jerry Fisher, The Aerospace Corporation**	2C5 Cancel	2C5 Using CMMI to raise the capability bar within Australia ***Mr. Keith Korzec***, Defense Contract Management Agency		***High Maturity***	2D5 Getting lost on the Way to Level 5 ***Ms. Kathy King***, The Center for Systems Management	2D5 Understanding Why? ***Mr. David N. Card***, Q-Labs	
Track 6 Wind River	***Transitioning to CMMI*** **Mr. Hal Wilson, Northrop Grumman Corporation**	2C6 Migrating Best Practices Within an Organization: Experiences in Adapting CMMI Policies and Procedures Used In One Part of a Business to Snother ***Mr. Scott Sherrill***, Georgia Tech Research Institute	2C6 An Enterprise Wide CMMI Implementation at Accenture ***Ms. Sarah S. Bengzon***, Accenture		***Transitioning to CMMI con't.***	2D6 Stakeholder Identification and Involvement in the CMMI ***Mr. James R. Armstrong***, Systems and Software Consortium	2D6 Ensuring the Right Process is Deployed Right: Synchronizing Process Checkpoints with Business Rhythm ***Ms. Joan Weszka***, Lockheed Martin Corporation	
Track 7 Wind Star	***CMMI for Small Projects and Organizations*** **Dr. Rich Turner, OSD**	2C7 Implementing CMMI in Small Businesses: A Mission Success Approach ***Mr. James E. Jones***, Support Systems Associates, Inc.	2C7 CMMI Implementation Strategies, CMMI Level 3, A small company experience, Artifact Ideas and Implementation ***Ms. Allison J. Heinen***, Mnemonics, Inc.		***CMMI for Small Projects and Organizations con't.***	2D7 Making PPQA Work on Small Projects ***Ms. Jean M. Swank***, Georgia Tech Research Institute	2D7 Does Size Matter In CMMI Implementation or Was Yoda Wrong? ***Mr. Paul H. Meyers***, SAIC	

CMMI Technical Tracks - Wednesday, November 16, 2005

Track	Session/Chair	Session A 8:00 AM	Session A 8:45 AM	BREAK IN DISPLAY AREA (9:30 AM - 10:30 AM)	Session/Chair	Session B 10:30 AM	Session B 11:15 AM	LUNCH IN GRAND MESA ABC (12:00 PM - 1:30 PM)
Track 1 Grand Mesa D/E	***CMMI and Process Improvement*** **Ms. Lorraine Adams, SEI**	3A1 A Change Agent in a Level 1 Organization; How to Survive in a Hostile Environment ***Mr. Andrew Cordes***, ABB - United States Corporate Research Center	3A1 "Sound Systems Engineering Using CMMI®" ***Mr. Michael T. Kutch, Jr.***, SPAWAR - Charleston		***CMMI and Process Improvement con't.***	3B1 Using CMMI to "Dig Out" from an Ad Hoc Development ***Mr. Donald A. Borcherding***, NexSummit, LLC	3B1 Strategic Planning; Selling a CMMI-based Improvement Effort to Senior Management ***Dr. Aldo Dagnino***, ABB USCRC	
Track 2 Grand Mesa F	***Practical Guidance*** **Mr. Fred Schenker, CSC**	3A2 Are You Making the Most Of Your Project Schedules? ***Ms. Susan Byrnes***, PMP, Natural SPI, Inc.	3A2 Dual-Shore Program Management Experience In Packaged Solution Development, Testing & Implementation ***Mr. Rajakumard Duraimurugan***, Infinite Computer Solutions		***Practical Guidance con't.***	3B2 Keeping the Team Motivated for Success ***Mr. Michael D. Scott***, Raytheon Missile Systems	3B2 Using a Level 3 Process to Achieve CMMI Level 3 ***Mr. Stephen Ross***, Raytheon Company	
Track 3 Highlands	***Appraisals*** **Mr. Geoff Draper, Harris Corporation**	3A3 Lessons Learned in helping large and small organizations prepare for their first appraisal ***Mr. Robert J. Pomietto***, Center For Systems Management	3A3 Behind Closed Doors ***Mr. Tom G. Lienhard***, Raytheon Missile Systems		***Appraisals con't.***	3B3 CMMI Appraisal Results: The Shocking Truth Revealed ***Ms. Margaret A. Glover***, SEI	3B3 Appriasers Gone Bad ***Ms. Margaret A. Glover***, SEI	
Track 4 Chasm Creek	***ROI & Benefits of CMMI*** **Dr. Dennis Goldenson, SEI**	3A4 Evaluating the Impact New Tools and Technologies Using Simulation ***Dr. David M. Raffo***, Portland State University	3A4 The ROI Dashboard (c) : Understanding the Benefits of CMMI ***Mr. Thomas L. McGibbon***, ITT Industries, AES		***ROI & Benefits of CMMI con't.***	3B4 Quality Assurance Involvement Compared to Program Results ***Ms. Jill Brooks***, Raytheon Company	3B4 Rapidly Achieving Measurable ROI Using Early Defect Detection ***Mr. Timothy G. Olson***, Quality Improvement Consultants, Inc.	
Track 5 Mesa Verde	***High Maturity*** **Mr. Jerry Fisher, The Aerospace Corporation**	3A5 Logarithms Can Be Your Friends: Controlling Peer Review Costs ***Dr. Richard L. W. Welch***, Northrop Grumman Corporation	3A5 Journeys on the Road to Level 5 ***Mr. Joseph V. Vandeville***, Northrop Grumman Corporation		***High Maturity con't.***	3B5 Lessons Learned on the SCAMPI Road to CMMI-Software Level 5 ***Mr. Joseph N. Frisina***, BAE Systems	3B5 Merging Measurement in Mature Companies - A Success Story of Measurement Process Integration ***Ms. Sharon Rohde***, Lockheed Martin IS&S	
Track 6 Wind River	***Transitioning to CMMI*** **Mr. Hal Wilson, Northrop Grumman Corporation**	3A6 ACncel	3A6 Combining Six IPTS and Transitioning To CMMI ***Ms. Judy Overhauser-Duett***, NAVAIR		***Transitioning to CMMI con't.***	3B6 How to Transition Models and Disciplines - Looking for Transition in all the Wrong Places ***Ms. Lori G. Smailes***, TYBRIN Corporation	3B6 Using SW-CMM SQA Independent Verification as A First Step for the Transition To CMMI ***Mr. Alfredo N. Tsukumo***, CenPRA - Centro de Pesquisas Renato Archer	
Track 7 Wind Star	***Measurement*** **Mr. Jeff Dutton, Jacobs Sverdrup**	3A7 Software Size Growth and Uncertainty - Both Affect Estimate Quality and Project Risk ***Mr. Michael A. Ross***, Galorath, Inc.	3A7 COCOMO II and COQUALMO Estimation Modeling ***Mr. Qingchuan Liu***, Motorola (China) Electronics, Ltd.		***Measurement con't.***	3B7 Building an Automated System to Support Measurement in CMMI ***Dr. Richard Hayden***, Pragma Systems Corporation	3B7 Team of Three - How to get Program, Functional and Process Management Working Together ***Mr. Mark A. Marsh***, Raytheon Company	

CMMI Technical Tracks - Wednesday, November 16, 2005

Track	Session/Chair	Session C 1:30 PM	Session C 2:15 PM		Session/Chair	Session D 3:30 PM	Session D 4:15 PM	
Track 1 Grand Mesa D/E	***CMMI and Process Improvement*** **Mr. Brian Gallagher, SEI**	3C1 Enterprise Process Integration within the Space and Airborne Systems Business Area of Raytheon ***Mrs. Deana A. Seigler***, Raytheon Company	3C1 Interpreting the CMMI: It Depends! **Dr. Rick Hefner**, Seimens Corporate Research	**BREAK IN DISPLAY AREA (3:00 PM - 3:30 PM)**	***CMMI and Process Improvement con't.***	3D1 CMMI as Safeguard Against Software Entropy: A Manager's Perspective ***Dr. Thomas F. Christian, Jr.***, 402 SMXG	3D1 "Its how big? How Will You Deploy It Without Killing My Team and My Program?" ***Mr. William J. Borkowski, Jr.***, Raytheon Missile Systems	**ADJOURN FOR THE DAY**
Track 2 Grand Mesa F	***Practical Guidance*** **Mr. Paul Croll, CSC**	3C2 Accelerating Process Improvement through Collaboration: The NAVAIR Systems Process Improvement Community of Practice ***Ms. Katie Smith***, Naval Air Systems Command	3C2 What the CMMI Doesn't Say About Training (But should!) ***Mr. Sree Yellayi***, Northrop Grumman Corporation		***Practical Guidance con't.***	3D2 CMMI GP 2.8 Interpretation and Implementation: Is This Practice Just about Numbers? ***Mr. Lseter Stamnas***, Norausky Process Solutions, Inc.	3D2 Creating Helpful Process Directives ***Mr. Kenneth I. Weinberg***, Raytheon Company	
Track 3 Highlands	***Appraisals*** **Mr. Geoff Draper, Harris Corporation**	3C3 Improving Document Reviews for Appraisals ***Mr. Kent McClurg***, Raytheon Company	3C3 Finding CMMI Compliant Artifacts and a Needle in a Haystack ***Mr. Adrio J. DeCicco***, Raytheon Company		***Appraisals con't.***	3D3 Lessons Learned and Best Practices for Evidence Collection in Preparation for a SCAMPI Appraisal ***Mr. Ben Berauer,*** Raytheon Company	3D3 Maximizing Value for SCAMPI(SM) Preparation ***Ms. Joan Weszka***, Lockheed Martin Corporation	
Track 4 Chasm Creek	***ROI & Benefits of CMMI*** **Dr. Dennis Goldenson, SEI**	3C4 CMMI Process Improvement: Its not a technical problem, its a people problem! ***Mr. Rolf W. Reitzig***, Cognence, Inc.	3C4 A Project's Perspective of CMMI Level 5 ***Mr. Warren Scheinin***, Northrop Grumman Corporation		**ROI & Benefits of CMMI *con't.***	3D4 Achieving the Promised Benefits of CMMI ***Dr. Rick Hefner***, Northrop Grumman Corporation	3D4 Measuring Economic Benefits of Process Improvement in CMMI Level 1 Organizations ***Dr. Aldo Dagnino***, ABB, Inc. US Corporate Research	
Track 5 Mesa Verde	***High Maturity*** **Mr. Jerry Fisher, The Aerospace Corporation**	3C5 The Road to Process Improvement Successes: CMMI Level 5/ISO 9001:2000 Business Model ***Mrs. Debra S. Roy***, BAE Systems National Security Solutions	3C5 Reducing Variation At Each CMMI Maturity Level ***Mr. Tim Kasse***, Kasse Initiatives, LLC		***High Maturity con't.***	3D5 Ways to Ensure the Culture Supports Level 5 ***Mr. Warren Scheinin***, Northrop Grumman Corporation	3D5 Analyzing Defects Can Tell a Story About a Company ***Ms. Diane A. Mizukami-Williams***, Northrop Grumman Mission Systems	
Track 6 Wind River	***CMMI Extensions*** **Mr. Randy Walters, Northrop Grumman Corporation**	3C6 Service Extensions to the CMMI ***Mr. Craig R. Hollenbach***, Northrop Grumman Corporation	3C6 Applying CMMI to Services ***Mr. Juan C. Ceva***, Raytheon ITSS		***CMMI Extensions con't.***	3D6 Management Challenges & Lessons Learned Implementing CMMI in a Services Environment ***Mr. Thomas E. Zience***, BAE Systems Information Technology	3D6 CMMI v1.1 for a Service Oriented Organization ***Mr. Steven K. Hall***, Raytheon Corporation	
Track 7 Wind Star	***Measurement*** **Mr. Jeff Dutton, Jacobs Sverdrup**	3C7 Cancel	3C7 Parametric Project Monitoring and Control: Performance-Based Progress Assessment and Prediction ***Mr. Michael A. Ross***, Galorath, Inc.		***Measurement con't.***	3D7 Measuring and Estimating Process Performance ***Dr. Richard D. Stutzke***, SAIC	3D7 Cancel	

CMMI Technical Tracks - Thursday, November 17, 2005

Track	Session/Chair	Session A 8:00 AM	Session A 8:45 AM		Session/Chair	Session B 10:30 AM	Session B 11:15 AM	
Track 1 Grand Mesa D/E	***CMMI and Process Improvement*** **Mr. Brian Gallagher, SEI**	4A1 "Barrier Busting" – Obtaining Active Leadership Support ***Mr. Michael D. Scott***, Raytheon	4A1 Cancel	**BREAK IN DISPLAY AREA (9:30 AM - 10:30 AM)**	***CMMI and Process Improvement con't.***	4B1 Don't Waste Time Writing the Wrong Processes ***Ms. Suzanne B. Zampella***, The Center for Systems Management	4B1 Contrasting CMMI and the PMBOK ***Mr. Wayne Sherer***, Anteon Corporation	**LUNCH IN GRAND MESA ABC (12:00 PM - 1:00 PM)**
Track 2 Grand Mesa F	***Practical Guidance*** **Mr. Paul Croll, CSC**	4A2 Supplier Management Strategy Considerations with CMMI ***Dr. Rick Hefner***, Northrop Grumman Corporation	4A2 Simplifying Process Tailoring To Project Execution ***Mr. Howard T. Kaplan***, Raytheon Company		***Practical Guidance con't.***	4B2 CMMI and Agile: A High Tech R&D Success Story ***Mr. Gene Miluk***, SEI	4B2 How to Incorporate "Lessons Learned" for Sustained Process Improvements ***Mr. Anil K. Midha***, BAE Systems	
Track 3 Highlands	***Appraisals*** **Mr. Geoff Draper, Harris Corporation**	4A3 Techniques for Shortening the Time and Cost of CMMI Appraisals ***Mr. Sam Fogle***, Systems and Software Consortium, Inc.	4A3 Using Classified Programs in CMMI Appraisals ***Mr. Kenneth I. Weinberg***, Raytheon Company		***Appraisals con't.***	4B3 The best intentions of SCAMPI V1.1; what we meant and what they heard ***Mr. Will Hayes***, SEI	4B3 Success the First Time: How to Get the Rating You Want or How to Fool Your Lead Appraiser ***Mr. Paul H. Meyers***, SAIC	
Track 4 Chasm Creek	***ROI & Benefits of CMMI*** **Dr. Dennis Goldenson, SEI**	4A4 The Effects of CMMI® on Program Performance ***Mr. Joseph P. Elm***, SEI	4A4 Squeezing Variation for Profit ***Mr. Donald R. Corpron***, Northrop Grumman Corporation		***SCAMPI B/C***	4B4 Process In-Execution Review (PIER) for Contract Monitoring ***Ms. Lorraine J. Adams***, SEI	4B4 Planning a SCAMPI C Appraisal from a Strategic Perspective ***Mr. John P. Kennedy***, The MITRE Corporation	
Track 5 Mesa Verde	***High Maturity*** **Mr. Jerry Fisher, The Aerospace Corporation**	4A5 Cancel	4A5 A Statistical Approach To Product Quality Assurance ***Mr. Randall J. Varga***, BAE Systems		***High Maturity con't.***	4B5 A Key to a High Maturity Rating is - ORGANIZATION ***Mrs. Karen M. Pelletier***, Northrop Grumman Corporation	4B5 Extending CMMI Level 4/5 Organization Metrics Beyond Software Development ***Ms. Linda R. Brooks***, Northrop Grumman Corporation	
Track 6 Wind River	***CMMI Extensions*** **Mr. Randy Walters, Northrop Grumman Corporation**	4A6 Tailoring CMMI for Use in an IT Services Environment ***Ms. Stacy Savage***, BAE Systems Information Technology	4A6 Interpretation of CMMI for Outsourcing and Associated Measures ***Dr. Hubert Hofmann***, General Motors		***CMMI Extensions con't.***	4B6 How to Become Your Customer's Software Provider Of Choice ***Mr. David Herron***, DCG, Inc.	4B6 CMMI® and Process Improvement at the LA AFB Space and Missile Center (SMC) ***Mr. Keith Wright***, SPARTA, Inc.	
Track 7 Wind Star	***Systems Engineering*** **Mr. Mike Phillips, HSBC**	4A7 Practical Experiences and Lessons Learned In Implementing CMMI ***Ms. Sandee D. Guidry***, TECHSOFT	4A7 Cancel		***Systems Engineering con't.***	4B7 Systems Engineering Influence Throughout the CMMI ***Mr. Tim Kasse***, Kasse Initiatives, LLC	4B7 Does Process Capability buy Product Assurance? – Implications for Safe and Secure Systems ***Mr. Paul R. Croll***, CSC	

CMMI Technical Tracks - Thursday, November 17, 2005

	Session/Chair	Session C	Session C
		1:00 PM	**1:45 PM**
Track 1 Grand Mesa D/E	***CMMI and Process Improvement*** **Mr. Gene Miluk, SEI**	4C1 Being Customer Oriented ***Mr. Tim Kasse***, Kasse Initiatives, LLC	4C1 Learning from Lessons Observed--Mitigating Resistance to Process Improvement ***Mr. Bob Norris***, National Geospatial-Intelligence Agency
Track 2 Grand Mesa F	***Practical Guidance*** **Lorraine Adams, SEI**	4C2 Cancel	4D2 Data Management: The Hidden Enabler or (The Key Data and Work Product Integrator) ***Mr. Lester Stamnas***, Norausky Process Solutions, Inc.
Track 3 Highlands	***Appraisals*** **Mr. Geoff Draper, Harris Corporation**	4C3 Quantitative Comparison of SCAMP A, B, and C ***Mr. Dan Luttrell***, Northrop Grumman Mission Systems	4C3 Performing standard and consistent global appraisals in large multi-cultural organizations ***Ms. Jeanine Courtney-Clark***, Integrated System Diagnostics, Inc.
Track 4 Chasm Creek	***SCAMPI B/C*** **Mr. Jerry Fisher, The Aerospace Corporation**	4C4 Critical Path SCAMPIs: Getting Real Business Results from Appraisals ***Mr. Michael J. West***, Natural SPI, Inc.	4C4 Using a SCAMPI C for Collective Improvement Across a Multi-Business Program ***Mr. Oktawian Nowak***, Motorola, Inc.
Track 5 Mesa Verde	***High Maturity*** **Mr. Andrew Boyd, Northrop Grumman Corporation**	4C5 Paladin Drives Forward to CMMI Maturity Level 5 ***Mr. Victor Elias, M.S***, Armament Software Engineering Center, US Army	4C5 Business Improvements Achieving CMMI(R) Level 5 at SAIC: Who Moved My Process? ***Ms. Sharon Cobb Flanagan***, SAIC
Track 6 Wind River	***CMMI Extensions*** **Mr. Randy Walters, Northrop Grumman Corporation**	4C6 Software Outsourcing with CMMI ***Dr. John W. Mishler***, SEI	4C6 Cancel
Track 7 Wind Star	***Systems Engineering*** **Mr. Jeff Dutton, Jacobs Sverdrup**	4C7 Future of Software Engineering Project Management and the CMMI ***Dr. Kenneth E. Nidiffer***, Systems and Software Consortium	4C7 Cancel

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CMMI® and Stakeholder Involvement

Worth the effort?

Date: November 14, 2005

Presented By: Jim Armstrong

Systems and Software Consortium | *2214 Rock Hill Road, Herndon, VA 20170-4227*
Phone: (703)742-8877 | *FAX: (703)742-7200*

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Agenda

- CMMI Stakeholder Content – What it is
- CMMI Stakeholder Sources – Where it came from
- Process Stakeholder Approaches – What folks do
- Issues – What's the problem
- Conclusions – So what now

CMMI Stakeholder Content

CMMI Terms

- **Stakeholder**
  - A group or individual that is affected by or in some way accountable for the outcome of an undertaking
- **Relevant stakeholder**
  - A stakeholder that is identified for involvement in specified activities and is included in an appropriate plan

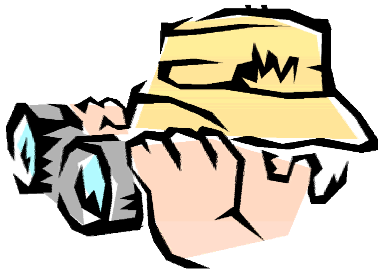
CMMI Comprehensive Stakeholder Tasks

GP 2.7 Identify and Involve Relevant Stakeholders

- *Identify and involve the relevant stakeholders as planned.*

PP SP 2.6 Plan Stakeholder Involvement

- *Plan the involvement of identified stakeholders.*



PMC SP 1.5 Monitor Stakeholder Involvement

- *Monitor stakeholder involvement against the project plan.*

IPM SP 2.1 Manage Stakeholder Involvement

- *Manage the involvement of the relevant stakeholders in the project.*

CMMI Stakeholder Involvements in SPs

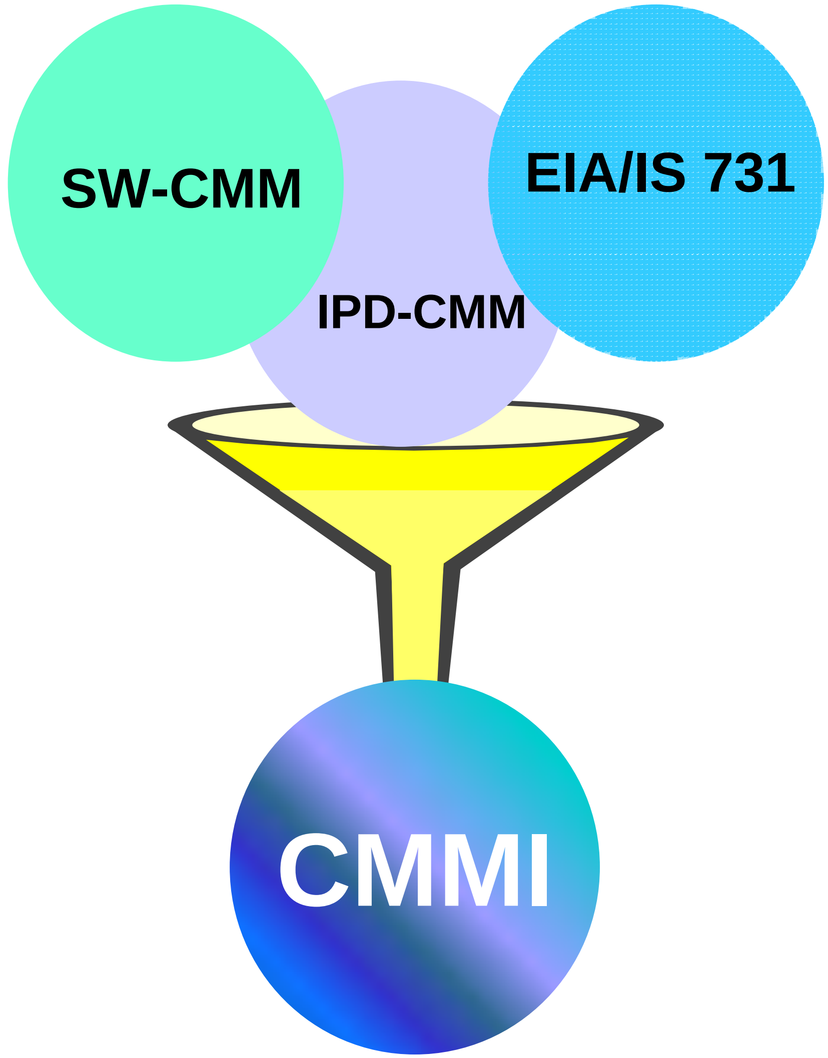
Explicit in Almost all PAs, particularly:

- **Obtain plan commitment**
- **Identify, negotiate, and track critical dependencies**
- **Resolve issues**
- **Develop requirements**
- **Measure and analyze**
- **Establish teams**

Implicit – GP 2.7

CMMI Stakeholder Sources

CMMI Source Models for Stakeholders



SW-CMM

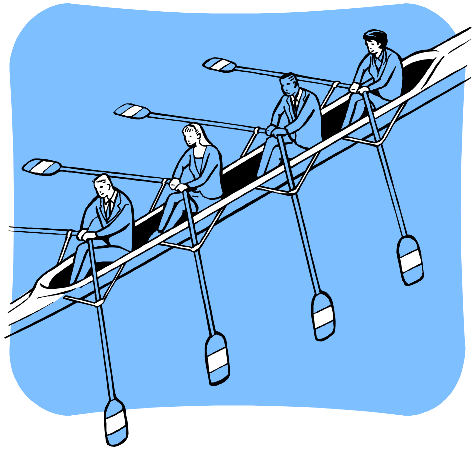
- Review by, participation of…
  - Other affected groups
  - Other engineering groups
  - Software related groups
  - Management
  - Customer
- Identification of…
  - Statement of work covers
  - … customer and end user
- Monitoring ??

EIA 731

- Stakeholders include
  - Customer/users, developers, producers, testers, suppliers, marketers, maintainers, disposers
  - Others who may be affected by, or may affect, the system or product
- Stakeholders are:
  - Involved in requirements
    - engaging all stakeholders in an ongoing dialogue
  - Review plans
  - Coordinate disciplines
- Identify??
- Monitor??

IPD-CMM

- A stakeholder is defined as one or a group who has/have a direct impact on or from the product or its production process
- References to
  - Identified
  - Communicate with
  - Collaborate with on vision
- Identify?? Note under leadership
- Monitor??



- Not released - no use and appraisal experience.

Additional Notes

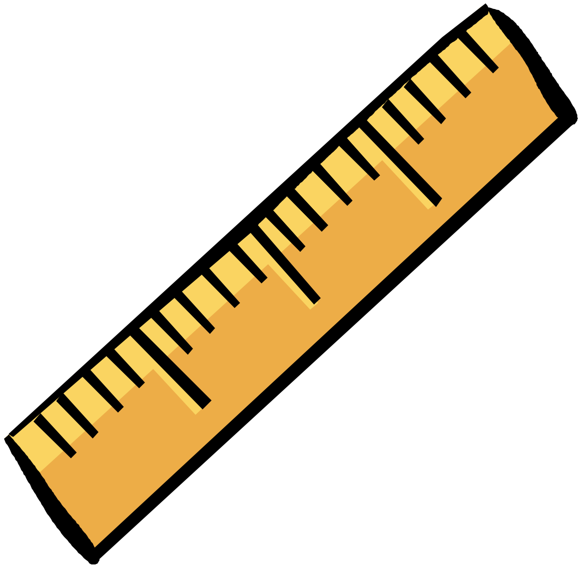
History of Integrated Product Development

- Stakeholder involvement has significant impact
  - Performance
  - Cost
  - Schedule
- Good involvement not natural

Process Stakeholder Approaches

Range of Options

- Assume it will work
- Let integrative tasks push involvement
- Emphasize identification
- Monitor participation
  - Quantity
  - Quality
- Address impact
  - Identify issues
  - Take actions to improve involvement



Participation Planning in Processes

How handled

- Pre-defined
  - Roles and responsibilities
  - Defined participant lists
- Definition tasks
  - Stakeholder matrices
  - Lists in plans, agendas

Results

- Strong on who is a stakeholder
- Weak on involvement specifics

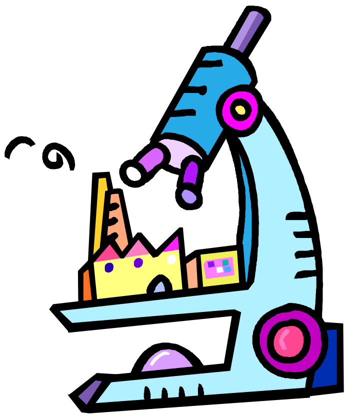
Monitor and Manage in Processes

- Attendance taken, but not much participation tracked
- Meeting canceled if missing or not prepared
- Not much in the way of raising as an issue or taking corrective action
- Could be included as a measurement

Observations

- General response – “We did this anyway”
- Some – “Made us think about it”
- Many changes due more to basic activity task than stakeholder practice
  - Requirements review now used
  - Integrated plan review brings stakeholders together

- Much on identification, little on managing



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The Issues

Issues

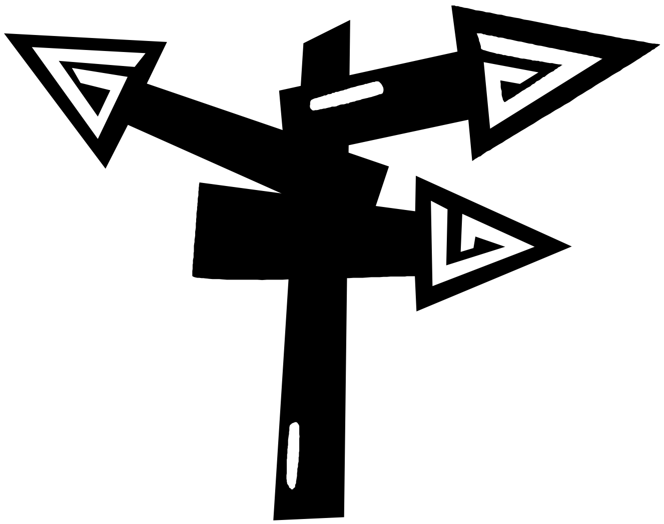
Increased emphasis on monitoring?

- Can a program manager answer:
  - How is stakeholder involvement working on your program?
    - Happening?
    - Impact?
  - What is the basis of your conclusion?

- What is the best balance between
  - The value of getting a better answer
  - The effort needed to get the answer

CMMI Model Options

- Eliminate, merge or reduce requirements
  - Delete GP and let PP, PMC and IPM suffice
  - Reduce monitoring language



- Leave requirements alone
  - Maintain current status
  - Change the way appraisals look at GPs
- Add requirements
  - Be more specific on assurance that planned involvement is as anticipated

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Conclusions

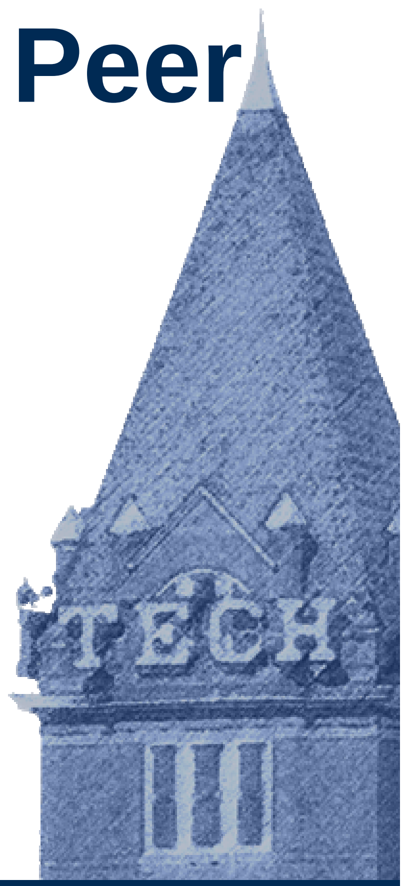
Conclusions - Usage

- Quite a range of options are available
- Minimum option is inviting
- Greatest weakness is on <u>managing</u> involvement
- IPD history shows impact of stakeholder involvement
- You must decide!

Conclusions - Model

- Need to consider:
  - Is everybody really tuned in to real stakeholder involvement?
  - Can appraisal issues be resolved?
  - Does the Generic Practice add significant value?
- Better data would help decision on content

Verification In CMMI Using Peer Reviews



Jeanne Balsam
Jean Swank

Electronic Systems Laboratory
Georgia Tech Research Institute
Georgia Institute of Technology

Who is GTRI?

- Unit of the Georgia Institute of Technology
- 1200+ employees
- Wide variety of products
- Customers include federal, state, and industry
- Projects range greatly in size and duration
- More Info:http://www.gtri.gatech.edu/

Current Status

- Assessed CMM level 3
- Performed gap analysis between CMM and CMMI
- Updating processes
- Implementing the new processes
- Not assessed under CMMI

Outline

- CMMI and peer reviews
- Purpose of peer review
- Formalize the peer review process
- Plan peer reviews
- General example of the execution of a peer review
- Secondary benefits of peer reviews

CMMI Verification Process Area Specific Practices

- SG 1 – Prepare for Verification
  - SP 1.1-1 – Select Work Products for Verification
  - SP 1.2-2 – Establish the Verification Environment
  - SP 1.3-3 – Establish Verification Procedures and Criteria
- SG 2 – Perform Peer Reviews
  - SP 2.1-1 Prepare for Peer Reviews
  - SP 2.2-1 Conduct Peer Reviews
  - SP 2.3-2 Analyze Peer Review Data
- SG 3 – Verify Selected Work Products
  - SP 3.1-1 Perform Verification
  - SP 3.2-2 Analyze Verification Results and Identify Corrective Action

What is a Peer Review?

"The review of work products performed by peers during development of the work products to identify defects for removal."

- <u>CMMI Guidelines for Process Integration and Product Improvement</u> (Addison Wesley, 2003, page 622)

What is Verification?

"Confirmation that work products properly reflect the requirements specified for them."

- CMMI Guidelines for Process Integration and Product Improvement (Addison Wesley, 2003, page 631)

Purpose

- Verify the work product meets requirements
- Identify defects or problems early in the life-cycle
- Gain confidence in work products
- Reduce risk

An Informal Peer Review

“Does this seem right to you?”

An Inappropriate Peer Reviewer

“Farmer Bob, does this seem right to you?”

Why Do We Need Formalized Peer Review Processes?

CMMI requires it!

A formalized process helps ensure:

- Peer reviews are taking place
- The right products are being peer reviewed at appropriate times
- Adequate resources are planned and allocated for peer reviews
  - The right reviewers are being selected
  - The reviewers are prepared adequately
- Defects are being recorded
- Defects are tracked to closure

Establishing a Peer Review Process

- Establish procedures for peer reviews
- Establish “ground rules” for peer reviews
- Provide guidance in what & when to peer review

Document the Peer Review Process

- Types of reviews
- What to review in each phase
- Planning
- Conducting
- Closing

Peer Review Types

Desk Check

- Single producer and single reviewer
- Cheapest, least effective review

Round Robin

- Single producer and at least two reviewers
- Reviewers examine work product sequentially
- A single defect log is used
- Moderator verifies defects are corrected

Structured Walkthrough

- At least two reviewers, a Moderator, and a Recorder
- All participants meet after reviewers have prepared
- More expensive and effective than a Round-Robin

Formal Inspection

- Roles and format similar to Structured Walkthrough
- Outside experts participate
- Advanced preparation is extensive and required
- Most expensive and effective review type

What to Review

Requirements

Design

Implementation

- Critical components
- Complex components
- New employee's work
- New technology or platform

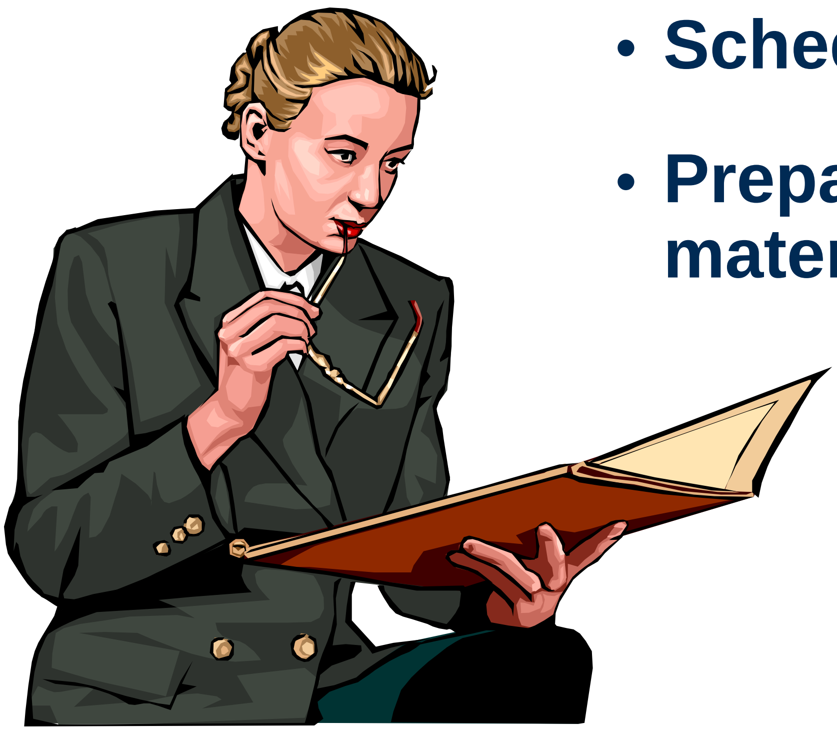
Test Plans

Plan Peer Reviews

- Determine what will be peer reviewed
- Determine when it will be peer reviewed
- Provide adequate budget for peer reviews
- Plan for critical reviewers
- Plan for appropriate facilities

Applying the Process

Prepare for Peer Reviews



- Choose reviewers
- Schedule meeting
- Prepare review and reference materials

Choosing Reviewers

- Knowledgeable and trained
- Some project-independent reviewers are desirable
- Non-management, unless special circumstances require a manager's participation
- Committed to adequately prepare

Scheduling the Meeting

- Allow the reviewers adequate time to prepare and turn in defect logs
- Define clear objectives regarding the amount of time (min/max) for the review preparation
- Limit meeting time to two hours
- Ideally choose a location with a networked computer, overhead projector, and access to configuration management system

Review and Reference Materials

- Review materials must be under version control
- Provide controlled defect logs to reviewers
- Identify location and version of all review materials
- Provide reference materials

Preceding the Peer Review

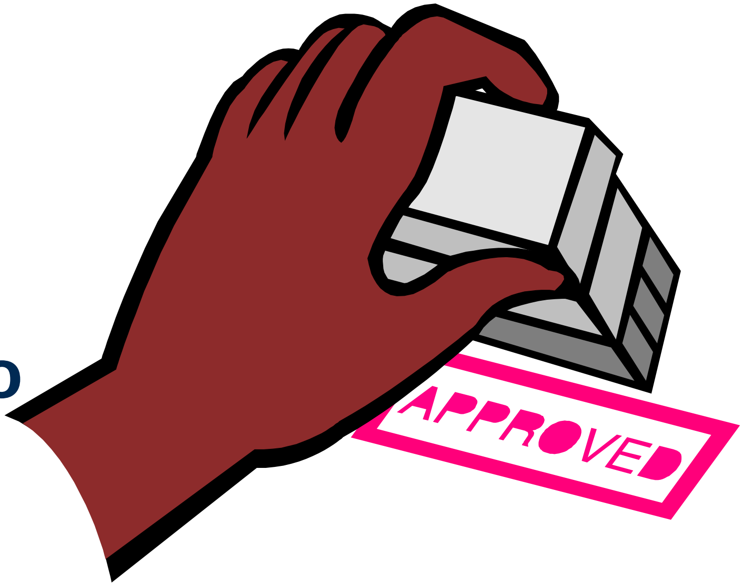
- Verify producer has distributed product
- Verify that reviewers are prepared
- Tabulate all the defects into a summary log

Conducting the Meeting

- Walk through the work product in its entirety; don't just look at the tabulated defects
- Ideally – use a projector so that everyone can see how defects are recorded
- Gain consensus during the review of the type, severity and disposition of each defect
- Identify, but don't try to fix the defects
- Determine if re-review is necessary

Closing the Peer Review

- Put peer reviews on the list of project deliverables so that closing them won't fall through the cracks
- Close out defects within 30 days or write a change request
- Re-review if necessary
- Require project director and quality engineer signature to close the review



Secondary Benefits

- Create mini-milestones for work products
- Jump-start team communication
- Product quality increases when the author knows it will be reviewed
- Create an esprit de corps within the project team - everyone has to be reviewed and act as a reviewer

More Secondary Benefits

- Leverage team member skills
- Teach junior engineers “It’s OK to criticize senior people’s work”
- Exposes junior engineers to direct tutelage from experts
- Expose reviewers from outside the project team to new ideas, and vice-versa

Questions?

VERIFICATION IN CMMI USING PEER REVIEWS

5TH ANNUAL CMMI TECHNOLOGY CONFERENCE AND USER GROUP

NOVEMBER 16, 2005

ELECTRONIC SYSTEMS LABORATORY

Georgia Tech Research Institute

Georgia Institute of Technology

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Verification In CMMI Using Peer Reviews

AUTHORS: JEANNE BALSAM, JEAN SWANK LEE SHEINER, AND MARK PELLEGRINI

INTRODUCTION

Georgia Tech Research Institute (GTRI) is the nonprofit applied research arm of the Georgia Institute of Technology in Atlanta, GA. The Electronic Systems Laboratory (ELSYS) of GTRI achieved a CMM Level 3 rating in June of 2003. ELSYS employs 150 engineers and scientists working predominately on DoD related competitively bid contracts. Over the last 30 years, ELSYS researchers have established national reputations in areas such as: monopulse countermeasures, advanced radar warning receiver design, survivability, simulation models and analysis, and Electronic Countermeasures (ECM) technique development. GTRI/ELSYS core competencies include software and systems engineering for electronic warfare and avionics systems, reliability and maintainability upgrades, technology insertion, obsolescence programs, threat analysis, and mission critical software.

This paper describes the Peer Review process utilized by GTRI/ELSYS. The procedures were developed originally to meet CMM for Software requirements. Over the last three years those processes have been extended to cover all systems components. These reviews can also aid in the validation of the product, if planned effectively and with the correct reviewers. Key features of effective peer reviews include:

- Selection of proper type of peer review for each work product and phase of development.
- Selection of peer reviewers who have the required knowledge and independence
- Detection of defects early in the lifecycle
- Reduction of risk of latent defects
- Documentation of defects and tracking them to resolution
- Utilization of supporting tools and environments for effective reviews
- Configuration management of review and reference material

Other benefits of peer reviews include:

- Consistency in the use of engineering standards and practices
- “Cross-pollination” of ideas and methods across the organization

If your organization is considering employing a peer review process you should find this information helpful in getting started. If you are already regularly conducting peer reviews you might find some of the topics discussed helpful in fine-tuning your process.

THE CMMI VERIFICATION PROCESS AREA

Peer reviews were a "Key Process Area" in the Capability Maturity Model (CMM) for Software. Under CMMI peer reviews are defined as a specific goal in the CMMI Verification process area. Essentially, the CMMI guidelines correctly classify peer review as a method of verification. Other methods of verification include, but are not limited to, audits, analysis, simulations, testing, and demonstration. Peer reviews (inspections, structured walkthroughs) can be one of the most cost-effective and productive tools you can use to create robust products on schedule and within budget. That is their theoretical potential. Without the other components (specific goals) of Verification, Prepare for Verification and Verify Selected Work Products, peer reviews lose value. For peer reviews to be effective they must be planned to take place throughout the lifecycle of the product. Additionally, verification procedures and criteria must be in place along with an environment that facilitates the peer review process.

There are several important objectives that peer reviews can accomplish.

Identify Defects Early

Early identification of defects is extremely important, and the ability of peer reviews to ferret out defects before they become expensive to fix is probably their single greatest benefit. A defect in requirements may only take a few hours to address and correct. If that same defect makes it from requirements into design and implementation, and is not caught until testing, it might take hundreds of hours or more to fix, as well as make it impossible to deliver the product on schedule and within budget. Early detection pays big dividends.

Verification

Peer reviews, or other verifications must be scheduled throughout the lifecycle of the system. Verification is the act of verifying that a work product is being built which implements the requirements of the system. As the Reviewers look at a work product, they should make sure that it is consistent with the work products produced earlier in the life-cycle. For example, the Reviewers need to verify that the design is not only feasible to implement, but implements the requirements placed on the module. Likewise, a peer review of a module's implementation should be verification that it accurately implements its design. Thus in all phases of the lifecycle the work products are verified against previous work products and against the system requirements.

Gain Confidence in Work Products

For project directors and technical leads, peer reviews increase their confidence that the team is making progress towards product completion. Setting the correct criteria for peer reviews and making a peer review the gate that a work product must pass prior to being considered complete provides the project director and technical leads with concrete information on which to base their plans. By peer reviewing work products one reduces the probability that some critical link is weak in the chain from requirements to a finished product.

Reduce Risk

By identifying defects early in the product life-cycle, peer reviews help reduce the risk of late delivery, a bad product, or an overrun. This benefit is achieved by performing peer reviews during each phase of a product's development. Early identification of risk areas allows for development of effective and timely project risk-mitigation strategies.

PLANNING PEER REVIEWS

Peer reviews don't just happen by themselves. They must be a part of project planning, otherwise sufficient resources will not be allocated to support them. Not only must time and budget be considered and planned, but critical personnel resources may need to be secured through formal commitments. At a minimum, peer reviews of important work products need to be scheduled as tasks on the project schedule. In ELSYS, peer reviews are required for requirements, design, and test procedures, so these peer reviews are part of the normally scheduled project activities. Peer reviews of selected code units are also required and scheduled. Placing these peer reviews on the project schedule not only assures that they are planned, conducted and closed, but also assures that they are specifically funded when budgeting for product development.

All peer reviews can not be pre-planned at the being of a project. As with all major project tasks management reserve should be set aside for follow-up peer reviews and additional peer reviews, which are scheduled for new or modified components.

WHAT AND WHEN TO PEER REVIEW

It is essential to conduct peer reviews at appropriate points in product development. Finding defects early in the product development process (i.e. requirements and design) provides the greatest return on investment. The ELSYS process requires that a Structured Walkthrough is conducted on all documentation (e.g., Word Document, slides, video, etc.) of requirements and designs. Test plans and test descriptions must be peer reviewed with at least a Desk Check, and in practice it is preferred that they be reviewed with a Structured Walkthrough that includes key designers and implementers of the product being tested. Deciding what to review when peer reviewing implementations is less straightforward when considering systems. Software development and hardware development have specific implementation details that warrant discussion. The following paragraphs provide some guidance on deciding the type of peer reviews that should be scheduled and major concerns specific to each type of development.

Software Implementations

In an ideal world, all code units would be peer reviewed with at least a Desk Check. We do have some projects where that is a requirement, particularly ones that are mission-critical. But sometimes the amount or severity of the defects found may not justify the expense to find them as compared to discovering them in unit testing or acceptance testing. In these cases a judicious use of limited peer

reviewing resources is warranted. The goal is to select a sub-set of code units for peer review. The following paragraphs provide guidance in that selection.

If the project team is using some new language or other new technology, a Structured Walkthrough of one of the first units produced is recommended. This will give the entire project team a chance to share their insights into the new tool using a real-world example. All who participate can benefit, not just the Producer of the product being reviewed.

Code that is written by someone who is inexperienced and/or new to the project team is a good candidate for peer review. In these cases it is especially important to conduct some type of peer review as soon as possible, preferably with their first code unit. If there are problems with coding standards, implementation approaches, or other aspects, it is important to find and correct these problems before they have been replicated in a large number of coded units. As always, early detection brings the most benefit.

Critical units are also good candidates for peer reviews. If a unit is essential to the performance of the product it should be peer reviewed. For example, a base class from which numerous other units are derived should usually be examined. A defect in this class might cost significant debugging time for many developers, magnifying the cost of the defect. Code units that are complicated and hence prone to errors, such as implementations of complex algorithms, are also good candidates for review. If the software is time-critical, units that are expected to be executed the most during run-time should be reviewed with an eye towards efficient implementation.

Hardware Implementations

By hardware implementations we are referring to the detailed construction designs from which functioning hardware can be fabricated. This includes circuit board schematics, fabrication drawings, etc. When deciding what hardware implementations should be peer reviewed, if the schedule or resources permit only a sampling of some work products, the same types of criteria that apply to software apply here as well. Implementations using new technologies, created by inexperienced producers, or ones that are critical units are good candidates for peer reviews.

For hardware items a further consideration is critical path and schedule. A long-lead item would be a candidate for peer review if it is in the critical-path. The cost of peer reviewing the implementation might be significantly more than the cost of the item itself, but a peer review would still be justified if a schedule slip would be extremely costly or multiple items are being produced.

REASONS FOR FORMALIZING THE VERIFICATION PROCESS

If you have never participated in a peer review, you may be wondering exactly what a peer review is. Actually, it is likely that you have already participated in many peer reviews without even knowing it. Walking down the hall and asking a co-worker to look at something you have produced is essentially a peer review, boiled down to its simplest form. You throw something on your friend's desk and ask, "Does this look right to you?" You are asking them to look at your work product and try to find defects in it. If you sit down with someone and discuss an approach you are thinking about using in a design, that is a peer review too.

These informal types of peer reviews are sometimes helpful, but are often ad-hoc, inefficient, or ineffective. A *verification process* takes this concept of seeking input from your peers and formalizes it. There are several excellent reasons for formalizing the verification process:

Assure Peer Reviews Take Place – Just because the potential exists for people to peer review each other's work doesn't mean that they actually do it. A formalized verification process defines what work products should be peer reviewed – and equally importantly – when they should be reviewed.

Select the Right Reviewers – A co-worker in the next office may be willing to look at your work product and give his opinion, but he may not be the right person for the job if what you are working on is outside his area of expertise. This means that not only will you be wasting his time, he will be wasting yours. And even worse, you might actually think that you've got a solid product because he didn't see any defects in it. He didn't see them because he was not the right person to be looking for them. A properly executed peer review process selects the right people to examine the product being reviewed.

Record Defects – Peer reviews produce a defect log that documents all of the problems in the work product that need to be corrected. Walking into a neighbor's office and spending a couple of hours discussing a design isn't helpful if by the time you get back to your office you've forgotten the details of his observations.

Verify Defects are Corrected – A list of defects is not only good for the Producer to use to address the defects in their work product; it is also good for someone to independently verify that the defects were fixed. Finding defects but not fixing them is a waste of resources and undermines the whole purpose of peer reviewing.

RULES FOR PEER REVIEWS

It is vitally important to have some ground rules for peer reviews. Criticizing people's work is a touchy subject at best. Doing it in a public, documented forum can be inflammatory and frightening. This is a hurdle that must be overcome when introducing a peer review process to an organization. Setting and enforcing rules is essential. Active enforcement of these rules may be necessary at first, but once your team has become used to the process of peer reviews this becomes less of an issue. Don't forget that new employees will be in the same boat the entire organization was when the process was first introduced. They will need special attention to get them introduced to the peer review process that has become second-nature to everyone else.

Rule 1: No Managers are Allowed in Peer Reviews

The purpose of peer reviews is to find defects, not to rate someone for evaluation purposes. Having a manager present at a peer review may stifle good communication. Reviewers may be inclined to hold back their criticism for fear of hurting the Producer's standing with their boss. And it is tough enough for a person to have problems in their work pointed out to them by their peers without the person determining their next raise sitting in the room with them.

As with any rule, there are always exceptions. If the manager has special expertise that is truly relevant to the work product being examined, an exception can be made. This special need for their expertise should be explained to the person whose work is being reviewed. The manager, if not already familiar with the peer review process, should understand that all peer reviews find defects, and this should not reflect poorly on his perception of the employee's work.

Rule 2: Peer Review Results are Confidential

Obviously if defects are recorded and shared among the peer review team, they are public to some extent. But specific peer review data should not be made generally available to people outside the project team. Metrics being collected for process evaluation should be aggregated when published to provide anonymity. The peer review team should use appropriate discretion and keep discussions confidential.

Rule 3: Review Products, Not People

Peer reviews are intended to find problems with work products, not the people who produced them. Under no circumstances should personal criticisms be allowed. The common enemy of everyone is the bugs lurking in the work products, and it takes a team effort to find them. This should be made clear to everyone who participates in a peer review. And don't let the Reviewers forget that it will soon be their turn to have their own work reviewed.

Rule 4: Expect to Find Defects

Once peer reviews become common, it will be obvious to everyone that all work products have defects. If your peer reviews aren't finding defects, you either have the wrong Reviewers, insufficient preparation, or you are targeting the wrong products. However, when peer reviews are new to the organization (or a new employee) it is a bit intimidating to have your peers compile a list of the defects in your work. Let everyone know up front that every work product has defects and their objective is to find them. Finding these defects benefits the product, and therefore the whole team.

Rule 5: Peer Reviews Convey No Retribution

There should be no negative consequences from participating in a peer review. Nothing that is related to a peer review should appear in evaluations or personnel files. It is essential for participants to be confident that what happens in a peer review is strictly a technical exercise for improving the group's work products and not something that will come back to haunt them.

TYPES OF PEER REVIEWS

ELSYS utilizes the four types of peer reviews briefly described below. The vast majority of our reviews are either Structured Walkthroughs or Desk Checks. Formal Peer Inspections are very rare.

Formal Peer Inspections

Formal Peer Inspections are typically only used in life-critical applications. A Formal Peer Inspection is a rigorous analysis technique, and thus is the most costly and time consuming of the four review techniques. Formal Peer Inspections must include domain experts from outside the project team. During the inspection, defects are identified and logged, and action items are assigned. The status of defects are tracked and communicated until the defect has been resolved. Formal inspections have the highest efficiency in terms of defect removal of any form of peer review.

Structured Walkthroughs

Structured Walkthroughs are similar to Formal Peer Inspections, but require fewer Reviewers and shorter preparation times. A Moderator guides the other members through the review of the work product, with the Producer(s) walking the group through the product. The participants ask questions and make comments about possible defects, violations of development standards and other problems. During the Walkthrough, defects are identified and logged, and action items are assigned. The status of defects are tracked and communicated until they are resolved. Structured Walkthroughs are less efficient at removing defects than Inspections, but are not as costly and require a smaller number of Reviewers.

Desk Checks

Desk Checks are private reviews carried out by a Producer and an experienced Reviewer. The Producer provides the Reviewer with a copy of the work product and associated materials. Desk Checks are the least expensive of the four review techniques. However, Desk Checks are the least effective review method and the effectiveness of the review depends almost entirely on the competence of a single Reviewer.

Round-Robin Reviews

Round-Robin reviews are a process of desk checking by multiple peers in a sequential manner. The initial Reviewer, who serves as the Moderator, completes a Desk Check and then passes the folder to the next Reviewer who performs another Desk Check, logging additional defects. This continues until all Reviewers have participated and the folder is returned to the Moderator, who then works with the Producer to ensure that defects are corrected. Round-Robin reviews are more efficient than simple desk checking, and typically cost less than Inspections and Walkthroughs. However, Inspections and Walkthroughs identify a greater percentage of defects.

PREPARING FOR A PEER REVIEW

Having a successful peer review is dependent upon proper preparation. The correct Reviewers must be chosen, the review must be scheduled, and the work products to be reviewed and defect logs must be properly controlled.

Choosing Participants

A Reviewer must have adequate knowledge of the work product being reviewed. Simply choosing someone to be a Reviewer because they have the time to do it despite the fact that they don't understand what they are reviewing is a waste of time and money. In the case of software products, the Reviewer should be familiar with the programming language, the application that is being developed, and the system to which it is being integrated. Likewise for hardware, the Reviewer should understand the tools and technologies being used.

It is also important for Reviewers to be able and willing to spend adequate time preparing for the review. When they are invited to participate in the peer review they should be told the minimum amount of time they are expected to spend to prepare for the review. If they cannot commit to this amount of time you should consider using another person as a Reviewer, or if the desired Reviewer is considered essential, rescheduling the review. Although in some cases peer reviews can be done "cold" (i.e. no advanced preparation), in most cases reviewing the material in advance is essential. Having a peer review with an unprepared Reviewer is generally "just checking the box," which may give the appearance of conducting a peer review, but is largely a waste of time. It can also hurt your peer review process in the long run by leaving defects undetected, giving the impression that the process is not worthwhile.

A Desk Check will have a single Producer and a single Reviewer. The choice of Producer(s) is straightforward – the person or people who created the work product. The choice of Reviewer, however, is more difficult and extremely critical if the peer review is to add value rather than waste money.

Round-Robins, Structured Walkthroughs, and Formal Peer Inspections employ multiple Reviewers. In these types of reviews it is not essential for each Reviewer to be an expert in everything, but between them they should possess the knowledge to understand the work product in its entirety. It is highly desirable to select at least one Reviewer from outside the project team. Having a Reviewer with a totally different perspective increases the chance of finding defects or better implementation methods. This also fosters cross-communication between projects.

A Moderator's primary responsibility is to run the peer review meeting. It is his job to be sure that all of the Reviewers participate and that no single Reviewer dominates the meeting. The Moderator must keep the meeting progressing and stop off-topic conversations that sometimes are a natural consequence of the discussion of the work product, but are not related to the goal of finding defects. It is understandable that people try to fix the defects they find during the meeting, but this is not its purpose. The Moderator must prevent problem-solving from displacing the goal of problem-finding. He must maintain a civil atmosphere during the meeting. The Moderator must be sure that the Recorder is capturing the defects correctly, and with enough detail that the Producer will understand the defect later, when it is time to correct the defect.

Scheduling

Peer reviews need to be scheduled far enough in advance to allow people to plan around them. This means that the reviews are normally scheduled before the work product is ready for review, anticipating the date that it will be ready. If the work product is not ready on schedule, the amount that it slips will cut into the cushion that you have allowed the Reviewers in their schedule. If this happens, you must either reschedule the review or verify that the Reviewers can adjust their schedules and complete the minimum amount of preparation by the meeting date. If they can't prepare adequately, a decision must be made as to whether the investment in the meeting time will still be a good one if the Reviewers go in with little or no advance preparation. Conversely, it is also useful to put a maximum limit on preparation time, particularly if budgets are tight. Although our experience is that getting too little preparation is more of a problem than too much, you may occasionally get someone who makes preparing for a review a full-time job when you intended for them only to spend a few hours doing so.

Reviewer Instructions

Reviewers should be given their priorities in their review preparation, particularly if the time available for preparation is limited. Different Reviewers may have different fortes. One Reviewer may be particularly good at spotting coding errors, whereas another may better understand the requirements allocated to the module in the context of the system of which it is a part. For example, a piece of code may work correctly, but not do the job it needs to do. This is a requirements issue. On the other hand, the code may appear to be doing the right thing, but the code contains a statement that uses a logical OR operation when a bitwise OR was intended. This is an implementation issue.

Meeting Length

The actual peer review meeting should be limited to two hours or less. After this length of time minds begin to wander as fatigue sets in, reducing the quality of the review. If the review cannot be completed within two hours, another meeting should be scheduled to complete it. Care should be taken when planning the meeting so as not to attempt to review too much material. If it is obvious that the work product is too large to be reviewed in a single meeting it should be broken down into smaller units, if possible, or scheduled with multiple meetings.

Controlling Review and Reference Material

It is vitally important that the work product being peer reviewed is under configuration management. If the work products are not being controlled you are peer reviewing a moving target. When Reviewers are told to begin their preparation they should be given specific revisions of the work product to review. The forms they use to record their findings should also document which revisions of the products they are reviewing. These forms themselves should be placed under configuration management control. The Reviewers should also be given a list of any reference materials they will need to adequately assess the product being reviewed.

Facilities

The facilities in which the review takes place can improve the convenience and possibly the quality of the review. A meeting room with a networked computer that hosts the configuration management tool provides convenient on-line access to materials to be reviewed, peer review forms,

and reference materials. A projection system can be used to display the computer screen's contents to all attendees. That content may be the work product under review, reference documents, or defect logs. Easy access to a printer capable of printing multiple size documents facilitates viewing anything that is hard to view via the projection system.

CONDUCTING A PEER REVIEW

In the case of Structured Walkthroughs it is important for the Moderator to verify in advance of the meeting that all of the Reviewers are adequately prepared and have completed their defect logs. If some Reviewers are not prepared, a decision must be made to hold the review and take the time to walkthrough the work product line-by-line (referencing associated documentation) or to reschedule the review. This situation can usually be avoided if the Moderator periodically checks with the Reviewers and monitors their progress. Sometimes preparing for a peer review falls to the bottom of the Reviewers' priority lists; being reminded about it will usually get people motivated to prepare.

The Recorder should take all of the individual findings and combine them into a single list on the summary form prior to the meeting. When doing this it is helpful to keep the Reviewers' initials associated with their findings for easy author identification. The findings should be sorted so that similar ones from different Reviewers can be discussed together. Referencing the findings by the page, line, or paragraph number of the work product makes this sorting easier.

Although having the Reviewers record defects in advance is important, the meeting should not simply focus on a review of the findings. It is also important for the Producer(s) to walk the group through their work product as this will often initiate questions and discussions that may uncover defects that were not noticed by the Reviewers during their preparation.

It is extremely important that all defects are captured on the summary form. When defects are recorded it is essential that they are clear and specific. The Producer must agree that what is recorded is understandable because it will be his job to fix the problem. It is also important that the Reviewers agree that the defect is captured accurately; otherwise the Producer will fix a problem that doesn't exist and fail to fix the one that does. The Moderator needs to make sure that the discussion during the meeting doesn't get ahead of the Recorder. If it appears that the group is generating findings faster than the Recorder can capture them, the Moderator needs to stop the conversation to allow the Recorder to catch up.

The purpose of peer reviews is to identify problems, not fix them. Assuming that the Producer is competent, he can fix his own problems; he just needs help in finding them. Any time spent in the meeting fixing a problem is time spent by all the participants, so it is normally not cost-effective to determine solutions during the meeting. It also consumes valuable meeting time, since the meeting is limited to two hours maximum. Any time spent fixing a problem is time not spent looking for other ones. However, there can be exceptions to this rule. If the work product is small enough that there is no question that there will be sufficient time to finish the peer review, some latitude can be given to problem solving. Presumably the people gathered in the room are experts in the product being reviewed. If the Producer needs some assistance in solving the problem, and it doesn't require too much time to discuss, it may be better to do it during the meeting rather than try to reconvene

the subject-matter experts at another time. It may also be possible that the problem is such that the Reviewers have a vested interest in how it is solved. In this case you are going to need their agreement anyway, so figuring out how to solve the problem during the meeting may be appropriate. The important thing is to be sure that there is sufficient time to finish reviewing the material that is the subject of the review. In our laboratory we sometimes table discussions of problem-solving until the peer review is finished, and then spend the remaining meeting time discussing solutions for the problems for which it is appropriate to do so.

At the conclusion of the review a decision should be made as to whether another review is necessary. If the defects are simple and straightforward to correct, another meeting is not normally needed. But if there are numerous changes needed throughout the product, or if large sections of entirely new material need to be generated to address defects, another meeting is warranted. Sometimes a Structured Walkthrough can be followed up by a Desk Check if the changes needed are significant but not too overwhelming. If the work product is critical, or the changes are extensive, another Structured Walkthrough may be needed.

CLOSING A PEER REVIEW

Although preparing for a peer review meeting and conducting the meeting itself is important, it is all for nothing if the defects that are found are never actually fixed in the work product.

Someone must be designated to verify that the work product is, in fact, corrected according to the findings generated during the review. In our process, the lead engineer verifies that the defects have been corrected and the project director signs the peer review form to indicate that he is aware of the completion of the peer review. We also have a project-independent quality engineer who verifies that the peer reviews have been closed in a timely manner.

Our process requires that defects must be closed within thirty days of the peer review meeting. If there are defects that cannot be addressed in that time-frame and they can be deferred, an engineering change request (ECR) is created to document that the defects exist and must be corrected when appropriate to do so. Opening the ECR allows the peer review to be closed, and the remaining defects are scheduled for correction through our normal engineering change request process.

SECONDARY BENEFITS OF PEER REVIEWS

In addition to their primary purpose of finding defects in work products, peer reviews can have some very beneficial secondary benefits. Many of these benefits are dependent upon a well designed and managed peer review process.

Leverage Team Member Skills

Hopefully you have at least one person in your organization who is so good at what he does that everybody wants him on their project; a "Super Star." The reality is the Super Star cannot work full time on every project in the organization, but can be time-shared to bring expertise to multiple projects. The Super Star will typically need a relatively small amount of time to review a design and find its flaws as compared to the amount of time it took the Producer to generate the design in the first place. After it is fixed it may be nearly as good as if the Super Star had done the whole job himself.

Share Information Across Team Boundaries

Peer reviews are a good opportunity for people to share information, particularly when some of the Reviewers are chosen from outside the project team. Peer reviews immerse developers who might otherwise never look at a colleague's work in a process where they must do so. The inclusion of developers from other project teams in peer reviews helps to expose both teams to each other's work and expertise.

Jump-Start Team Communication

People on a development team, particularly if they don't really know one another, sometimes communicate poorly. A peer review process imposes a structure on them where they must not only communicate, but do so in a manner that is centered on constructive criticism. Once they are used to the idea of critiquing each other's work, they will find it easier to do so in informal situations. This is especially helpful to junior personnel, who might be uncomfortable with the idea of criticizing a more senior person's work.

Create Mini-Milestones

Scheduling a work product for a peer review adds another milestone to the product in addition to its completion milestone. The peer review date is typically scheduled in advance of the completion of the work product. This mini-milestone can motivate the producer to form a cohesive work product earlier in the product life-cycle, because it can be difficult or embarrassing to reschedule the meeting.

Increase Product Quality from the Start

If the producer knows from the beginning that his work will be examined in a peer review, it is more likely he will follow good practices while crafting the product. This benefit extends to units that are not initially scheduled for peer review if there is some expectation that they might be inspected due to a planning change.

Expose Junior Staff to Expert Tutelage

Peer reviews provide an ideal setting for junior staff members to interact with experts in their field. That interaction generally extends beyond the peer review through continued information exchanges to ensure corrections are made appropriately.

Create a Team Esprit de Corps

Being on both the Producer and Reviewer end of peer reviews breaks down barriers and gives the team shared experiences. In addition, if properly trained and encouraged, the project team members each realize that finding defects, regardless if they are their own or someone else's, benefits the product and therefore the whole team.

PRACTICAL CONSIDERATIONS

If your organization has not used a peer review process and you wish to do so, you will most likely be facing an initial wall of resistance that you will need to break through in order to be successful. If your developers have not had other people closely reviewing their work, particularly their code, they may find it an uncomfortable idea. They may not see the value in it, and will find reasons as to why they do not have the time to prepare for reviewing other people's work.

It is important to set the tone correctly right from the start. People need to understand that improving work products is the point, not trying to see who has the most (or least) defects in their work. Actually, sometimes a low number of defects found is more of a reflection on the quality of the Reviewers' efforts than the quality of the product reviewed. A cordial and cooperative atmosphere needs to be encouraged, and personal criticism cannot be allowed or it will poison the whole process. The first reviews may be a bit clumsy, and the number and type of defects found may be less than what you expect. But with experience things will get better. Make sure that check lists are developed and updated with the kinds of problems to look for. Once people sit on both sides of the reviewer/reviewed fence they will have empathy for each other. And when people see serious problems wrung out of their products long before they are built into them, they will see the value in doing peer reviews. In ELSYS we went from having to nearly twist some people's arms to get them to participate to a point where peer reviews are now part of our corporate culture. Now we often hear people ask, "When are we going to peer review that?"

If you have developers who are completely unwilling to participate in peer reviews with the proper attitude it is probably better to exclude them from the process at first. Get people with positive attitudes to pioneer your process. You will undoubtedly have some bugs in your processes that you'll need to iron out, so it is far better to include people who want to make the process work. Once you have a cadre of people who are reaping the benefits the word will get out. The naysayers will see their colleagues building better products with fewer problems, and that will encourage them to participate in the peer review process as well.

Verification In CMMI Using Peer Reviews

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SUMMARY

A peer reviews is a tool, but like any tool, the idea is to get more work out of it than you put into it. And if you don't know how to use the tool, or choose to use it incorrectly, your effort will be wasted.

Here are some things you should keep in mind when designing, implementing, and practicing a peer review process:

- The most important goal of a peer review is to find defects
- Keep managers out of peer reviews unless they have technical knowledge that is essential
- Keep peer review results confidential within the team to the greatest extent practical
- Remember that you are reviewing products, not the people who produced them
- Expect to find defects – nobody is perfect… nobody!
- Do not use peer review results to punish people
- Choose participants who have the expertise to be effective Reviewers
- Get a commitment from Reviewers to spend an appropriate amount of time preparing
- Schedule meetings to allow sufficient time for Reviewers to prepare
- Place any work product that is being reviewed under configuration control
- Keep peer review meetings under two hours in length. Schedule another session if needed
- Keep the meeting moving, and on topic
- For Structured Walkthroughs, provide a meeting room with facilities that support the review
- Provide Reviewers with any needed reference material
- Instruct Reviewers where to concentrate their examination, if appropriate to do so
- Identify defects in a peer review, don't fix them, unless special circumstances warrant it
- Make sure that all defects are recorded clearly and accurately
- Verify that all defects from a peer review are closed appropriately
- Maintain a cordial atmosphere during peer review meetings; do not tolerate personal criticisms
- Select an appropriate peer review type for the product being reviewed
- Peer review requirements before design begins; peer review designs before implementation
- Peer review, at a minimum, complex implementations and/or critical components
- Peer review test procedures
- Peer review critical-path items
- Foster an atmosphere where the team understands that finding defects is a good thing that benefits everyone.

5th Annual CMMI Technology Conference and User Group – Executive Panel

"How Has CMMI Improved Our Program and Project Performance – Or Has It?"

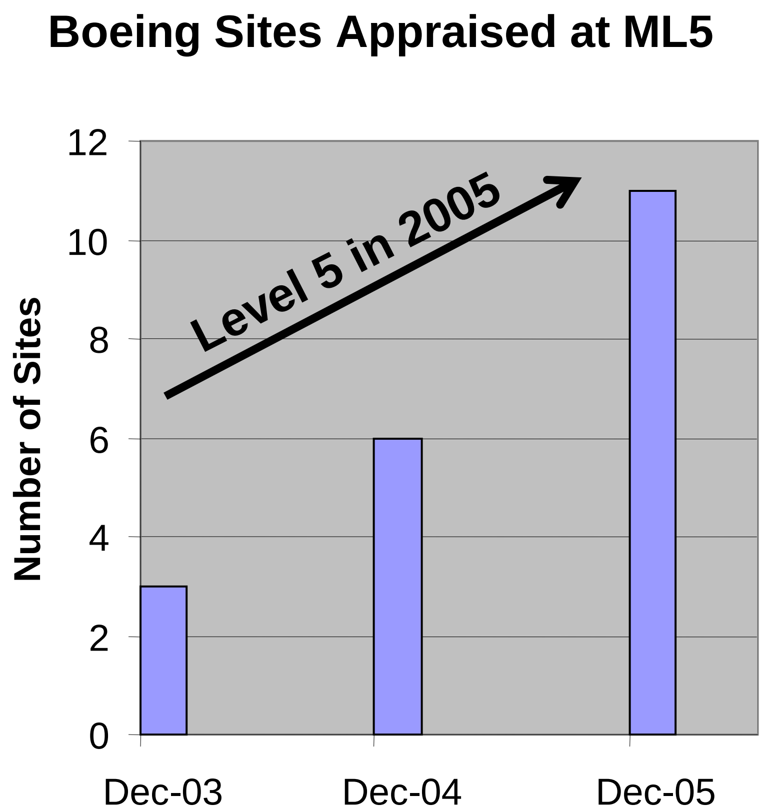
Dev A. Banerjee
Division Director, Systems & Flight Engineering
Boeing – Integrated Defense Systems (IDS)

November 15, 2005

Topics

- CMMI Deployment and Use
- Common Process Initiatives
- Plans for SE Management on Programs

CMMI Maturity Level – All IDS Business Units and All Major Sites



Note: Based on CMMI assessments at most sites in SW, SE, IPPD, and Supplier Management.

Boeing Is Committed to CMMI

Domain Expertise & Experience - Independent Reviews

Baldrige National Quality Program

Overarching Framework
- Management Leadership
- High level visibility

Business Excellence

ISO

Registration
- Process documentation standard
- Quality measurement system

Boeing Proprietary

PMBP

Program Management Best Practices

Management
- Maturity matrix
- Review feedback

Lean

Lean Enterprise

"How to" Strategies
- End to End
- Value Stream Analysis

CMMI[SM]

Capability Maturity Model Integration

Process Improvement
- Implementation
- Metrics driven

Systems Engineering

Execution
- SE Plan
- Maturity

Concept of SE Execution

- Use **CMMI in its fullness** to manage process maturity
- Incorporate **Program SE Performance Management**
  - Work-product metrics and **trends**
  - Methods for using assessments and metrics to manage the program
- Create a **customer/contractor partnership** to develop "structured management" on the programs

Focus on SE Practice and Related Measures to Ensure Program Success

Assessment Initiatives Hierarchy

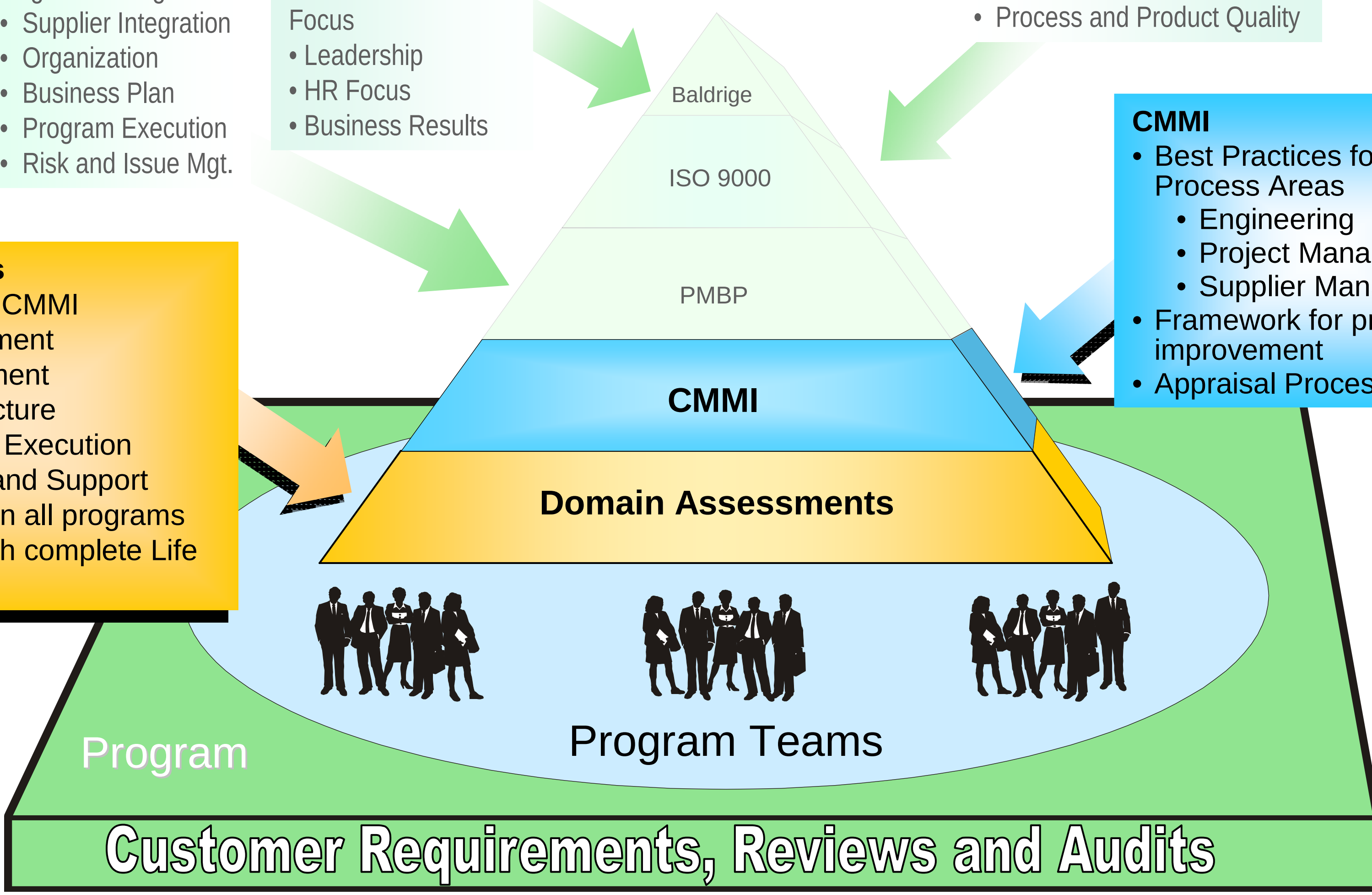
PMBP (Boeing)
- Program Management
  - Supplier Integration
  - Organization
  - Business Plan
  - Program Execution
  - Risk and Issue Mgt.

Baldrige
- Customer / Market Focus
- Leadership
- HR Focus
- Business Results

ISO 9000
- Customer & Market Focus
- Manage Business
- Process and Product Quality

CMMI
- Best Practices for selected Process Areas
  - Engineering
  - Project Management
  - Supplier Management
- Framework for process improvement
- Appraisal Process

Assessments
- Expands on CMMI
  - Management Commitment
  - Infrastructure
  - Program Execution
  - Monitor and Support
- Performed on all programs
- Done through complete Life Cycle



Topics

- **CMMI Deployment and Use**
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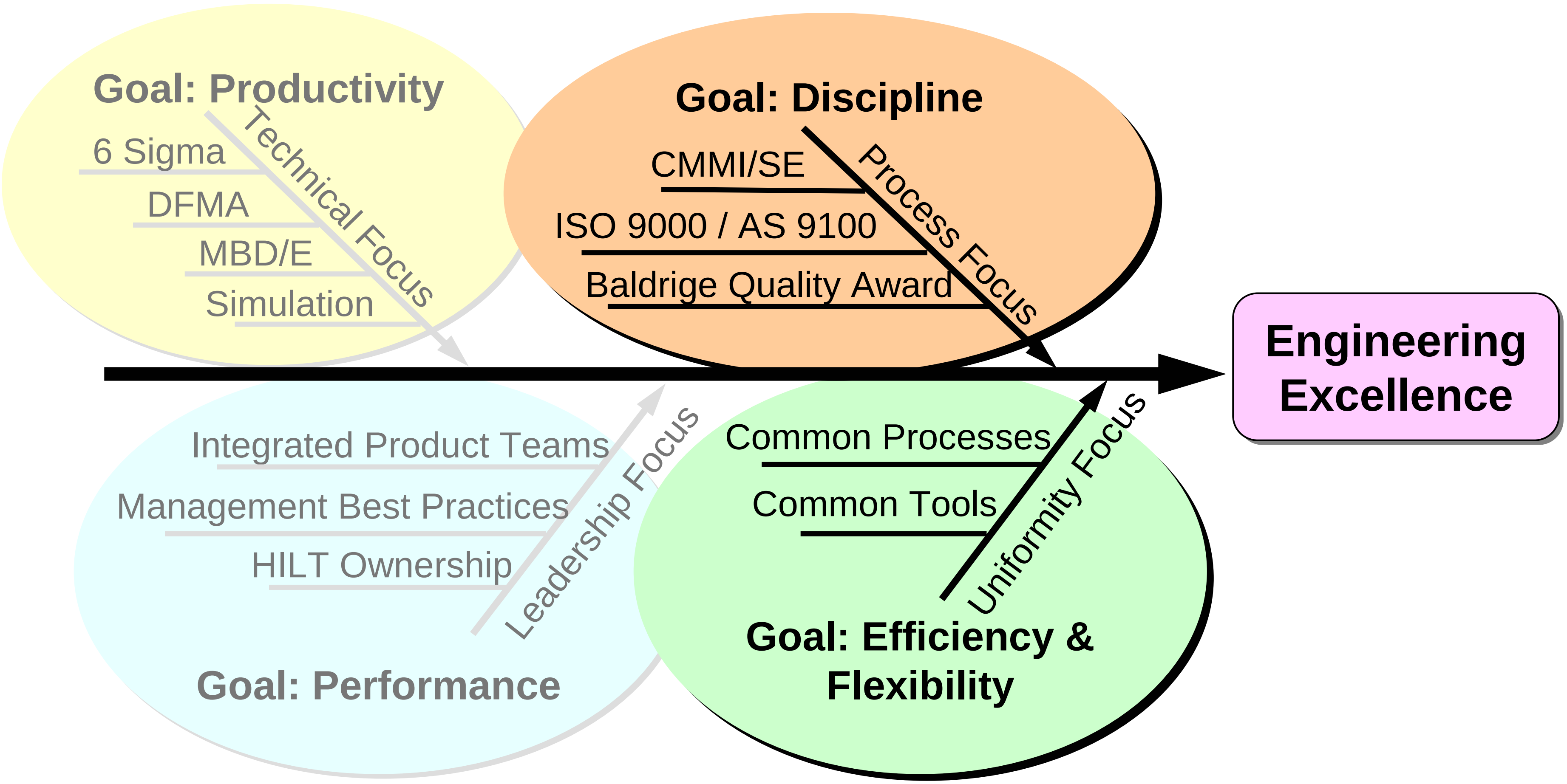
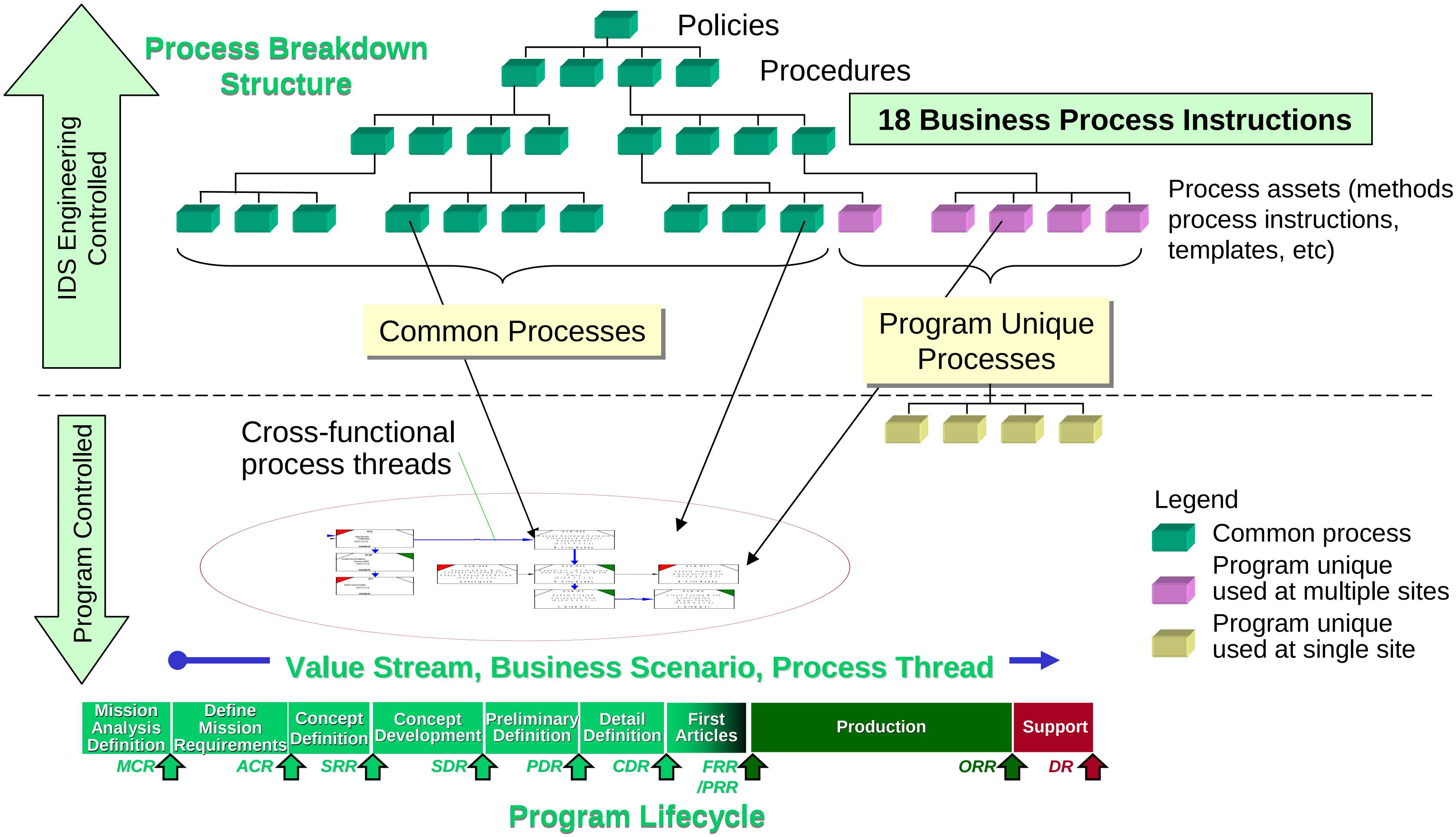
Improvement Initiatives



Boeing Has Defined Common Processes Consistent with CMMI

Applying Common Process Assets on Programs



Topics

- **CMMI Deployment and Use**
- **Common Process Initiatives**
- **Plans for SE Management on Programs**

Strengthening SE Execution at IDS

Management Commitment

- Boeing Strategy/Policies
- Leadership
- Resources

Infrastructure

- Comprehensive SE process assets
- Subject Matter Experts
- SE integration across sites

Implementation/ Execution

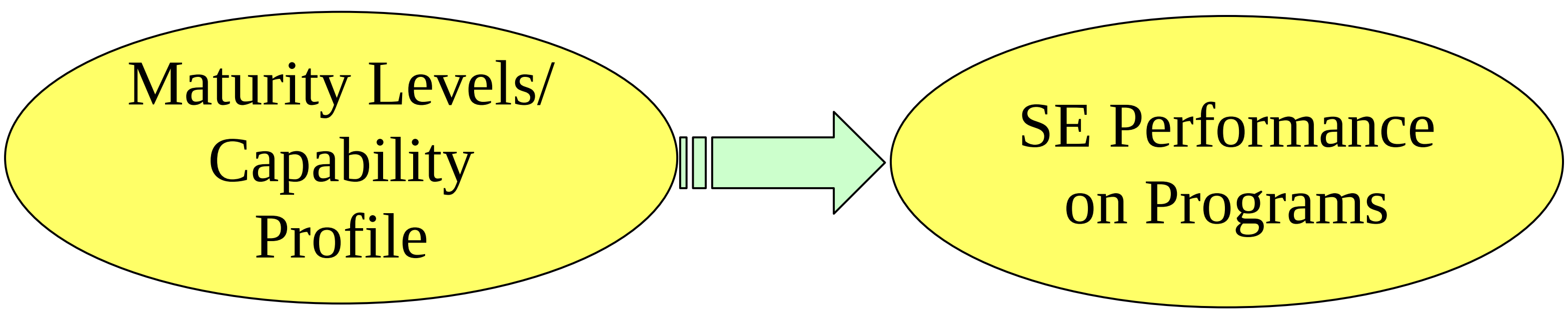
- Planning
- Resources
- Organization / RAA

Monitor and Support

- Disciplined assessment process
- Leading indicators

Summary

- **Maturity level** and **Capability profile** are necessary, but not sufficient for SE maturity
- Recommend deployment of SE processes and metrics to ensure **program's ability to execute**



High performance. Delivered.

An Enterprise Wide CMMI Implementation at Accenture by Sarah Bengzon

NDIA CMMI Technology Conference

Denver, Colorado

November 2005

Learning Objectives

- About Accenture
- Business Context
- Implementation Scope
- Key Program Components
- Guiding Principles

About Accenture (NYSE: ACN)

Accenture is a management consulting, technology services, and outsourcing company. Committed to delivering innovation, Accenture collaborates with its clients to help them become high-performance businesses and governments.

Comms & High Tech	Financial Services	Government	Products	Resources
• Communications • Electronics & High Tech • Media & Entertainment	• Banking • Capital Markets • Insurance	Serving sectors: • Defense • Postal • Education • Revenue • Human Services • Immigration • Justice/Security • Election Services	• Automotive • Health Services • Industrial Equipment • Pharmaceuticals & Medical Products • Retail & Consumer • Transportation & Travel Services	• Chemicals • Energy • Forest Products • Metals & Mining • Utilities

Business Context

In a changing business context, the cost of not delivering quality services is high and can have a significantly impact to the business.

- **Market growth**
- **Bigger, more complex programs**
- **Offshore components**
- **Growing, diverse workforce**
- **Increasing competition**

Implementation Scope

To operate as a high performing business, Accenture needs to operate with process rigor and consistency across a global and complex business model.

- **All Operating Groups**
- **All geographies**
- **Multi-lingual, multi-cultural**
- **Complex business and technology solutions**
- **CMMI SW/ SE/ IPPD**

Key Program Components

- **Governance and Program Management**
- **Awareness and Sponsorship Building**
- **Mobilization**
- **Deployment**
- **Process Improvements**
- **Measurement and Assessments**

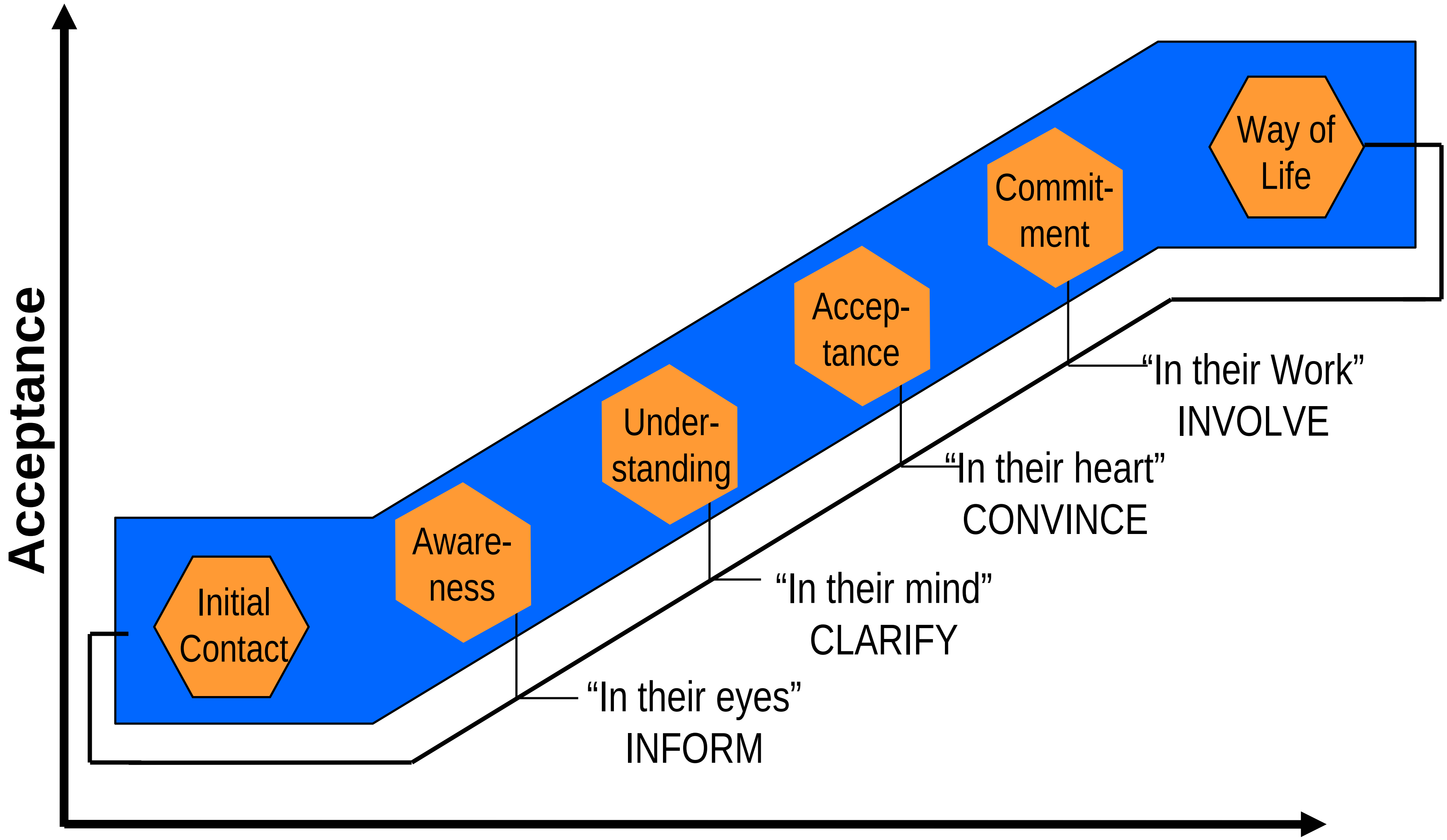
Governance and Program Management

- **Senior Executive Governance**
  - Provide overall direction and leadership
  - Provide key decision making

- **Small Central Program Management Team**
  - Define and maintain policies, process assets
  - Provide standard training and communications
  - Coordinate appraisals
  - Facilitate best practice sharing
  - Support deployment

- **Larger 'Local' Implementation Teams**
  - Develop local quality plans
  - Tailor standard assets
  - Implement training and communications plan
  - Implement quality program
  - Share best practices and experiences

Awareness and Sponsorship Building



Mobilization

- Planning
- QPI team sourcing
- Monthly training
- QPI communications
- Standard QPI processes and tools
- QPI deployment support and cross-OG issue resolution

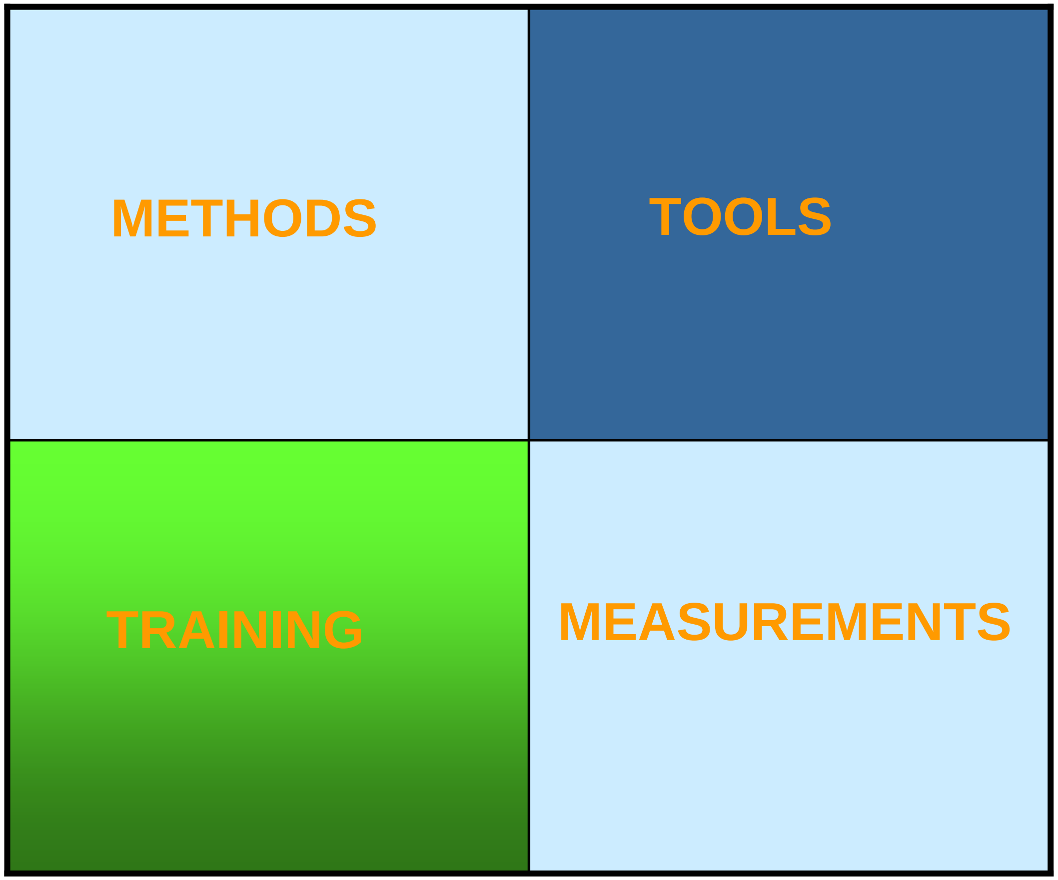
Note: QPI (Quality and Process Improvement)

Deployment

- Provides projects with standard processes, tools, coaching, and training on systems/ software engineering and project management disciplines
- Provides coaching and mentoring
- Provides monthly reviews against best practices
- Provides increased visibility into project execution

Process Improvements

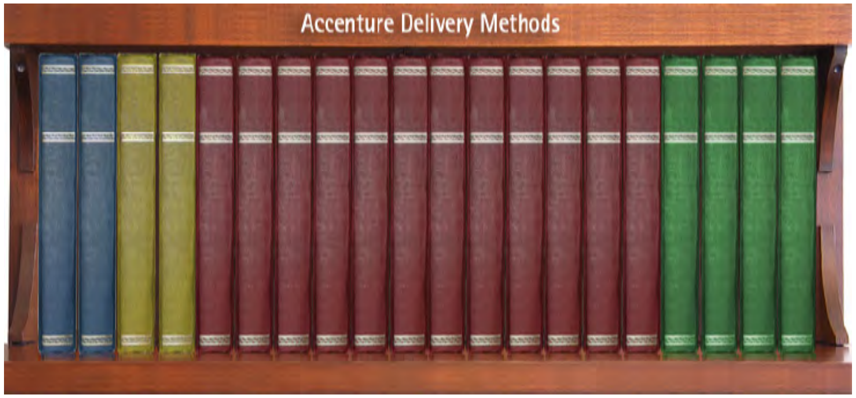
As we continue our enterprise wide CMMI implementation, there is a continuous improvement cycle to standard capability infrastructure.



Process Improvements - Methods

All Accenture people, regardless of where they are located, use the same methodology. This gives us the ability to move work to the most capable and cost effective location(s).

- Common language
- Distributed work model
- Standard transition points
- Guidelines for planning and managing distributed work

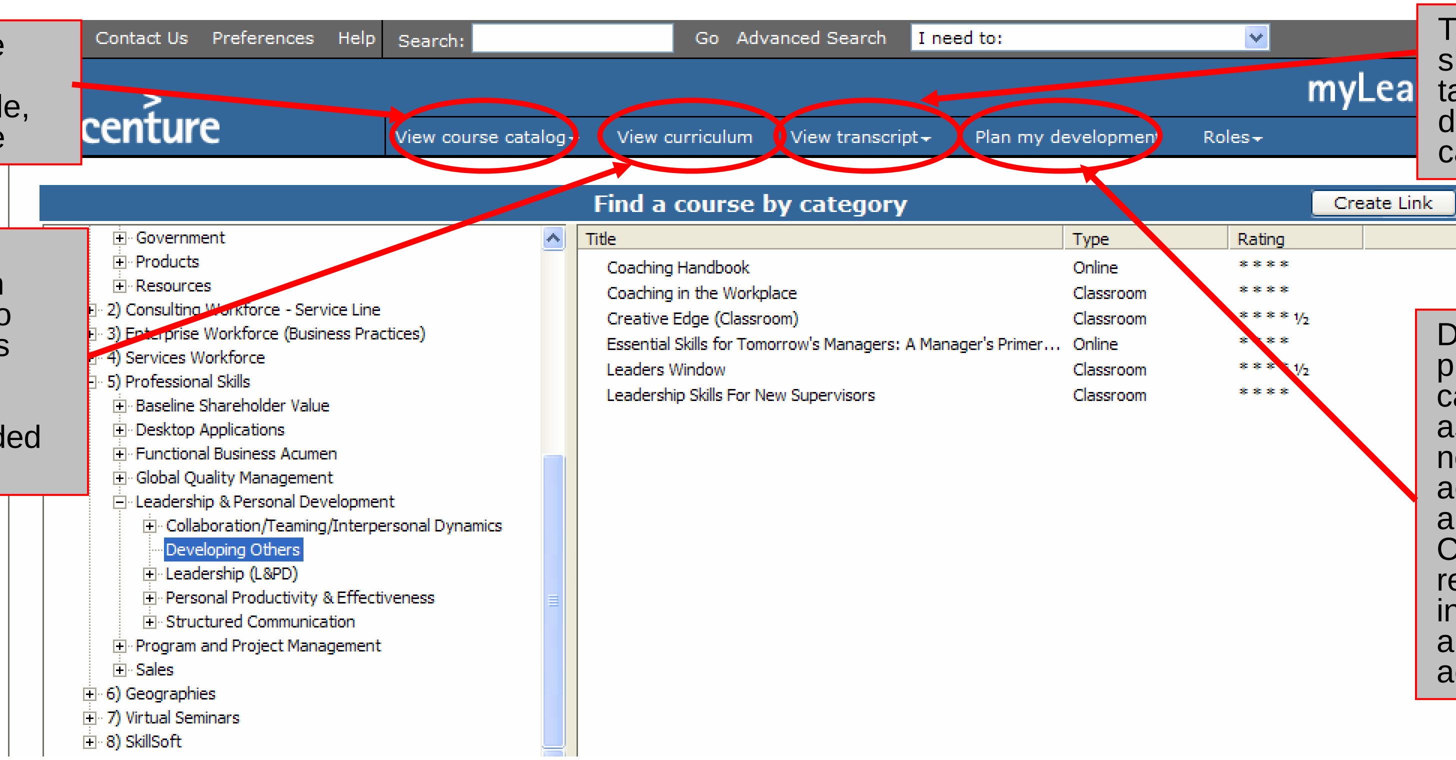


Process Improvements - Training

Best practices are woven into standard methods and deploying via enterprise wide training curriculum.

View course catalog by category, title, or certificate

Transcript shows courses taken, waived, denied, or cancelled.



Curriculum allows each employee to see courses specifically required or recommended for them

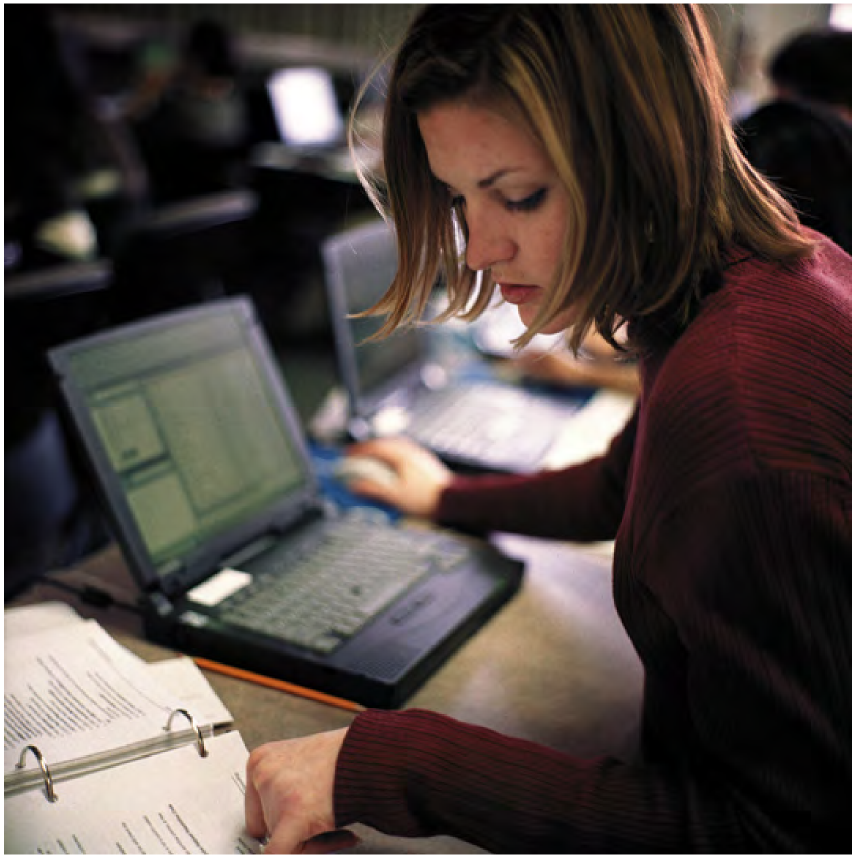
Development plans shows career aspirations, skill needs, and actions taken and planned. Career advisors review and indicate approval for all actions.

Measurement and Assessments

- Multiple baselines appraisals in 6 months covering all operating groups and geographies

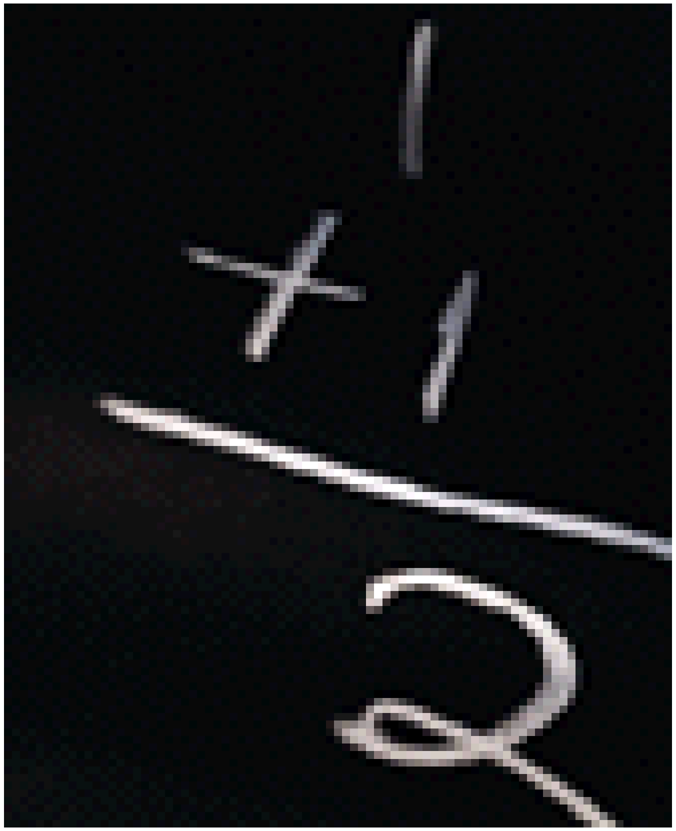
- Multiple CMMI service providers

- Reuse of separate organizational appraisal for common infrastructure



Guiding principles

- Build once, implement consistently.
- Balance consistency with flexibility.
- Use and reuse what is available.
- Common approach for select geographies and types of work.
- Integration with other corporate programs.
- Strong governance model.
- Consistent appraisals and actions.



High performance. Delivered.

Questions?

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Q-Labs© Shaping your Processes for Competitive Advantage

Understanding "Why?"

David N. Card
dca@q-labs.com

Based on D. Card, Understanding Causal Systems, *Crosstalk*, October 2004

Agenda

- The Problem
- Basic Concepts
- Defect Classifications
- Causal Analysis in the CMM and CMMI®
- An Opportunity
- Summary

CMM and CMMI® are registered trademarks of Carnegie Mellon University

The Problem

- Many of the potential benefits of measurement and analysis activities depend on effective causal analysis
- Causal analysis often produces superficial or no meaningful action, even in “mature” organizations

Examples of Weak Results

- Identified cause does not lead to any action
  - Bad data
  - Personnel issues
- Causes and actions are superficial
  - Defect rates from inspections are low, so *reinspect*
  - Defect rates from inspections are high, so *orient* the producer
- Only a small number of problems may result in false OOC signals or OBE (overcome by events) situations
- Tendency to stop at “first plausible explanation”

Contributors to the Problem

- Misunderstanding of basic concepts
  - Causality
  - Causal system
- Inadequate defect classification schemes
- Ad hoc causal analysis processes
  - Bad habits
  - Differences between CMM and CMMI

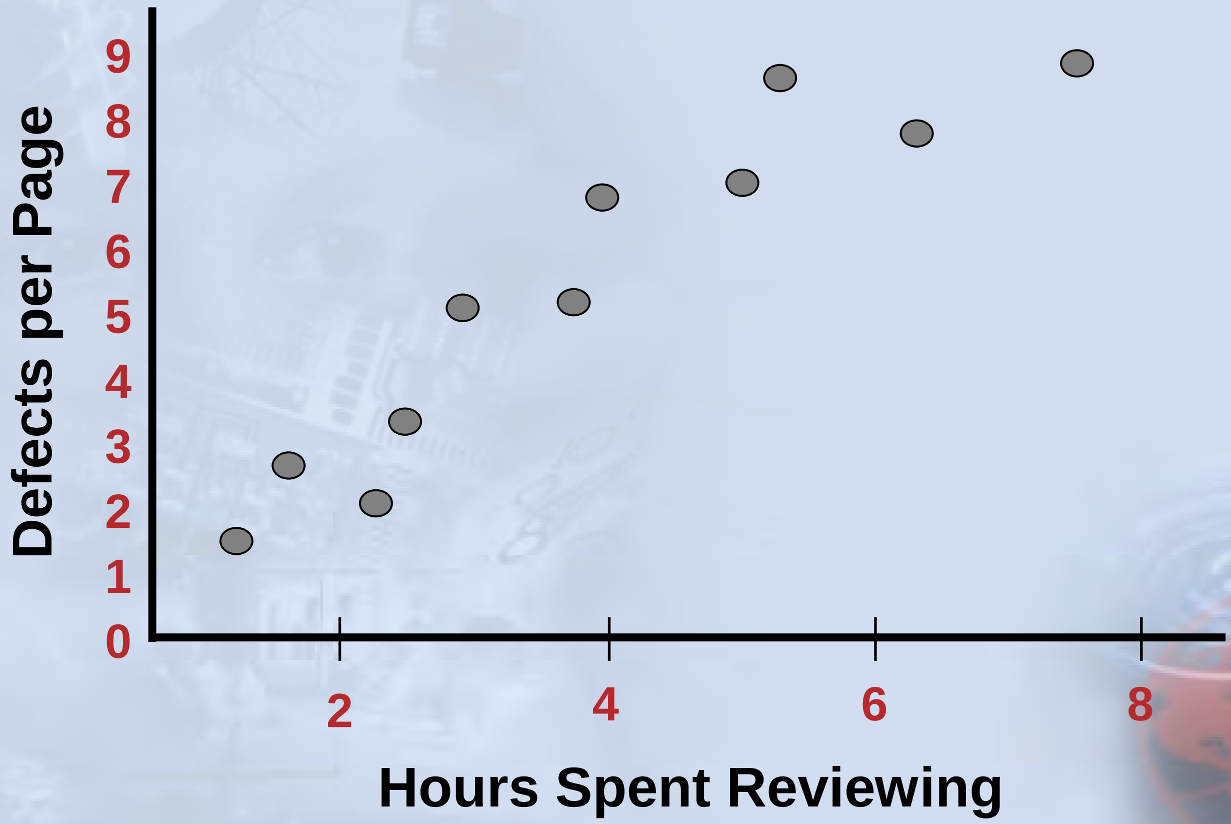
Causal Analysis

- Examination of information about problems, with
- Intent to identify causes of defects so that they can be prevented or detected earlier, or so that appropriate corrective action can be taken
- Many different approaches, called defect causal analysis or root cause analysis, employ many different techniques
- Performed in response to an *anomaly* or as part of a continual improvement program

Concept of Causality

- Conditions of causality
  – *Cause* and *effect* must demonstrate association or correlation
  – *Cause* must precede the *effect* in time
  – Mechanism by which the cause produces the effect must be identified
- Assignment of cause in a “human-intensive system” always includes a significant element of subjectivity

A Causal Relationship?



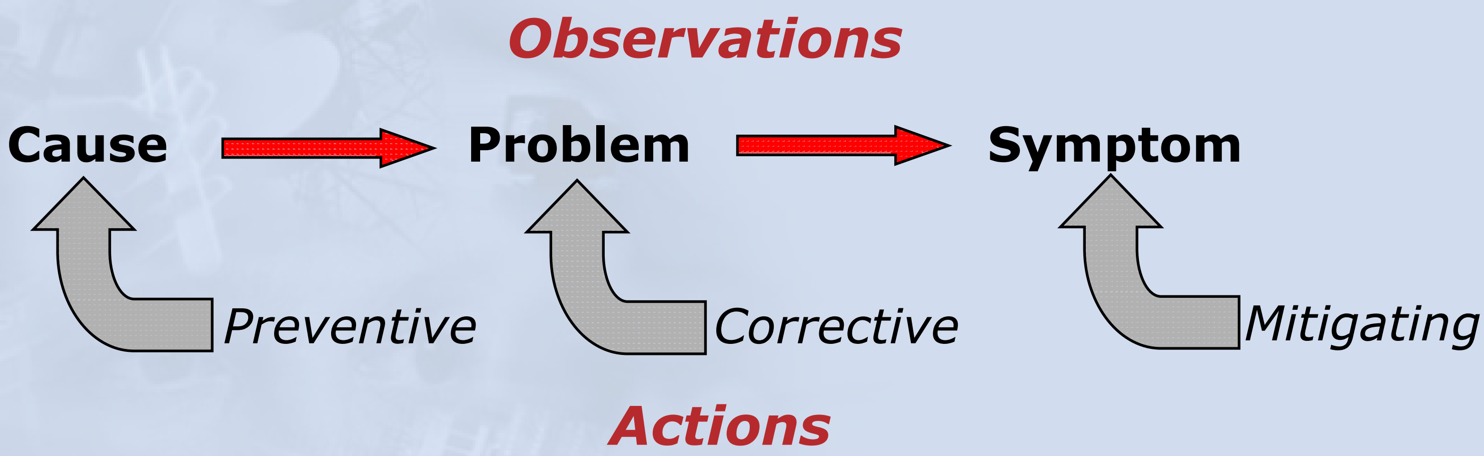
Causal System

- Network of interacting factors that affect an outcome of interest
  - Causes may linked hierarchically or laterally — causes may be effects, too!
  - A vocabulary limited to *cause* and *effect* usually isn't sufficient for reasoning about a causal system

Terminology for Causal Analysis

- The *problem* is the critical issue
- *Symptoms* usually are the most readily visible consequences of the problem
- *Causes* contribute to the occurrence of the problem
- *Systematic problems* are those that repeat

Elements of a Causal System



- Action may be taken on many different elements of a causal system
- Selecting the right action depends on the cost of the action and the expected impact on the system

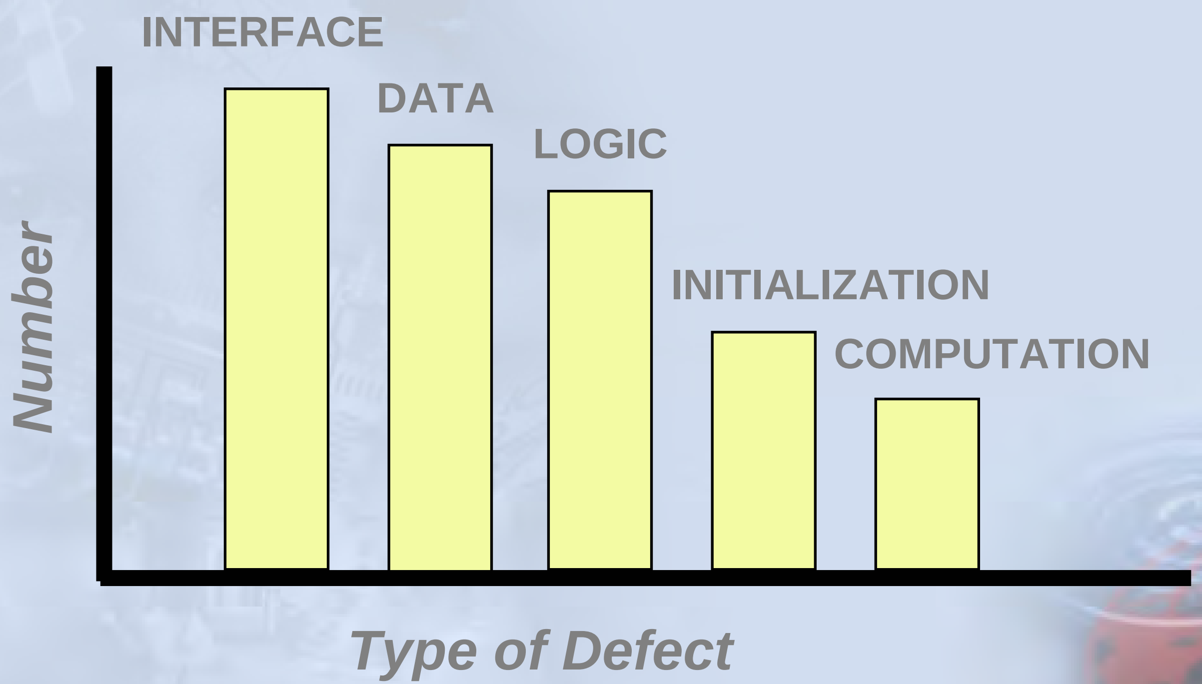
Defect Classifications

- Meaningful classifications are essential to identify trends and “systematic errors”
- Most common dimensions include:
  - when inserted (activity)
  - when found (activity)
  - type of error made
- Type of error may be specific to the work product or phase
- Classifications are intended as a tool for gaining insight
  - May require customization to problem domain
  - Must be understandable to engineers

“Ideal” Attributes of Classifications

- Orthogonal Dimensions
- Mutually Exclusive Categories within a Dimensions
- Objective Criteria for Assigning Categories
- Sensitivity to Behavior – changes in behavior result in changes in meaures

Example Pareto Chart



NASA Software Engineering Laboratory Classification

Causal Analysis Process

- Causal analysis assumed to be “intuitive”
- Processes, procedures, and tools often minimal
- Insufficient emphasis on ensuring that the right people participate
- CMM/CMMI-required “structure” added later

Relationship to CMM

- Level 4 — Defect Causal Analysis
  - May be ad hoc, bad habit!
  - Performed in response to *out of control* situations
- Level 5 — Defect Prevention
  - A Key Process Area (KPA) of CMM
  - Systematic approach required for DCA – “in accordance with a documented procedure”
  - Performed even when process is *in control*
  - Additional planning and feedback requirements

DP Planning

- Based on results of process performance analysis provided by (Quantitative Process Management (QPM), Software Quality Management (SQM), Process Change Management (PCM) activities
- Defines
  - Focus of DP activities (e.g., problem area)
  - Charter, composition, roles, and responsibilities of defect causal analysis team(s)
  - Charter, composition, roles, and responsibility of action team(s)
  - Schedules for phase kickoff meetings
- May not address all project activities and products

Phase Kickoff Meeting

- Provides regular feedback from DCA sessions
- Entire project staff participates
- Typical topics
  - Lessons learned (Dos and Don’ts) from previous projects and builds
  - Defect causal analysis and other process improvement activities to be conducted
  - Goals and objectives for this phase
  - Changes to methods and tools for this phase

Causal Analysis and Resolution

- CMMI Process Area at Level 5
- Differences from CMM DP
  - Phase Kick-off Meetings not addressed
  - Planning requirements relaxed (management versus technical plan)
  - Scope broadened to include all types of anomalies, not just defects
- DP provides the more challenging set of requirements

Relationship to Six Sigma

- Many causal analysis techniques provided in typical Six Sigma training programs (e.g, Error Modes and Effects Analysis)
- Defect prevention planning and team-based approach to DCA (CMM requirements) usually are not explicit elements of Six Sigma
- DP in the SW-CMM, and CAR in the CMMI, assume processes are defined; the need to define processes prior to DCA increases the time and effort required

Opportunity – IEEE 1044

- IEEE Standard 1044 – Classification of Software Anomalies (1995)
- Working group established to revise this standard
- Goals of revision
  - Incorporate current concepts
    - Inspection defects
    - Orthogonal defect classification
    - Defect causal analysis
    - CMMI, Six Sigma, etc.
  - Extend to defect prevention and improvement from just problem management
- Some face-to-face meetings, but most work to be accomplished off-line

Summary

- Regular and effective causal analysis is an essential element of any continuous improvement program
- Many concepts of causal analysis are misunderstood
- DP (CMM) and CAR (CMMI) requirements differ in some important ways
- Do causal analysis right – from the start!
  - Training
  - Good classifications
  - Systematic process

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About Q-Labs

- Consulting and Appraisals in Software Measurement, CMM/CMMI, ISO 9000, SPICE, etc.
- International Company
  - France
  - Germany
  - Sweden
  - UK
  - USA
- 120 employees
- ISO 9001 Certified

- A broad international client base, e.g.
  - Alcatel, Bouygues Telecom, France Telecom, Orange
  - AXA, BNP Paribas, Banques Populaires
  - ABB, R. Bosch, EDF, IBM, Siemens, Schneider Electric, Thomson Detexis, Volvo, Sony
  - Atomic Energy Board of Canada, FAA, Norwegian Ministry of Justice, Swedish Civil Aviation Administration
  - Thales, Thomson, FMV, US Army TACOM

Prioritizing Process Improvement Strategies in CMMI to Optimize Business Objectives

Aldo Dagnino

**ABB Inc.
US Corporate Research Center
Raleigh, NC**

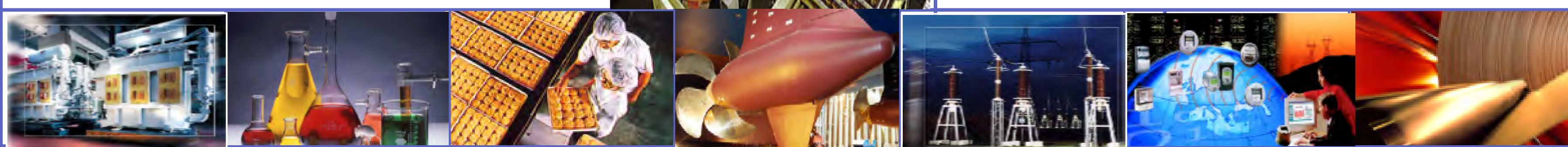
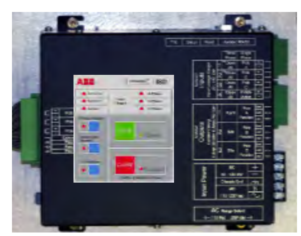
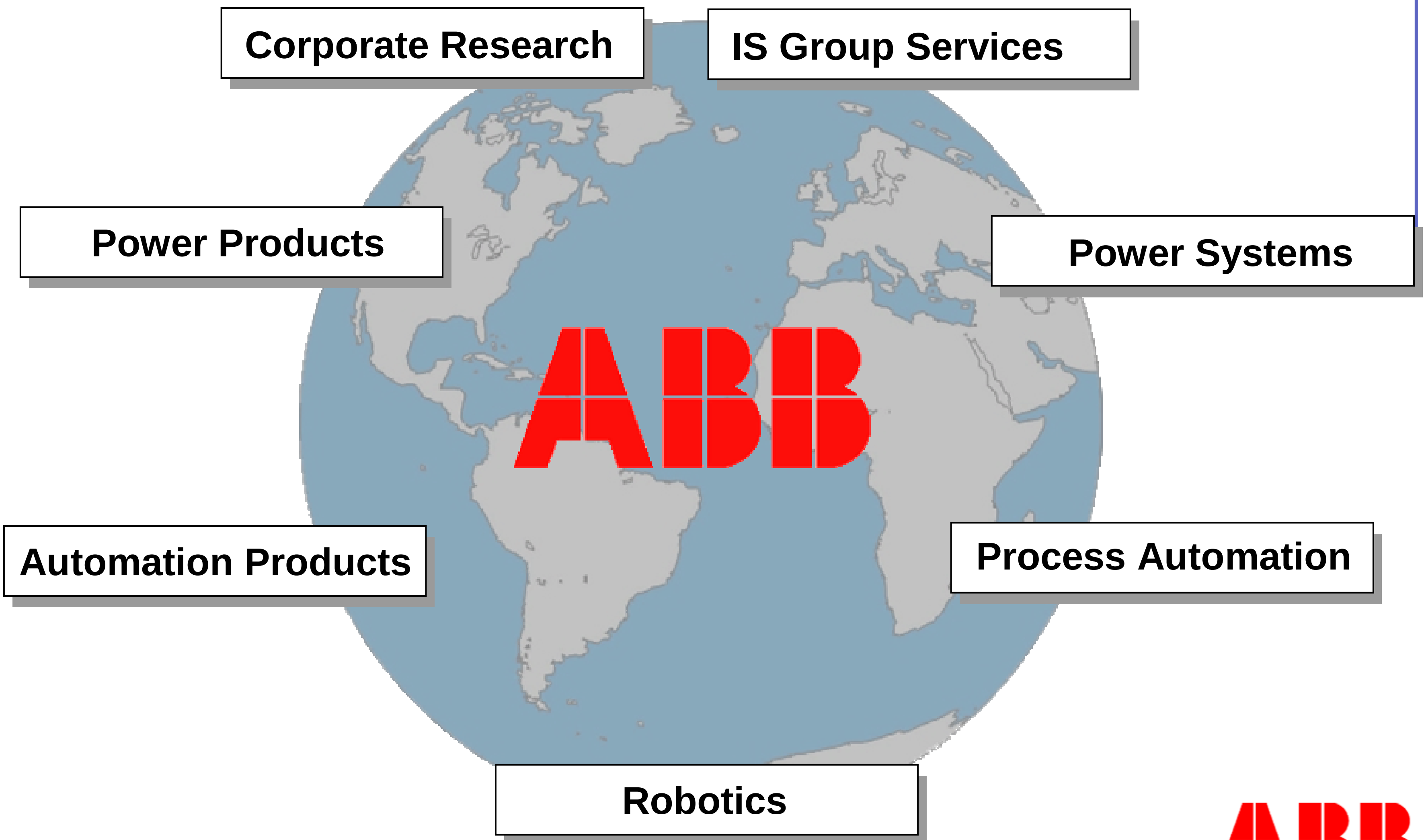


ABB Overview

- Leader in power and automation technologies
- Enable utility and industry customers to improve performance while lowering environmental impact
- ABB's products help operate Utilities, process industries, manufacturing plants, and other industries
- Present in over 120 countries and employs 110,000 people
- First company in the world to sell 100,000 robots
- A vast majority of ABB products have software & hardware components



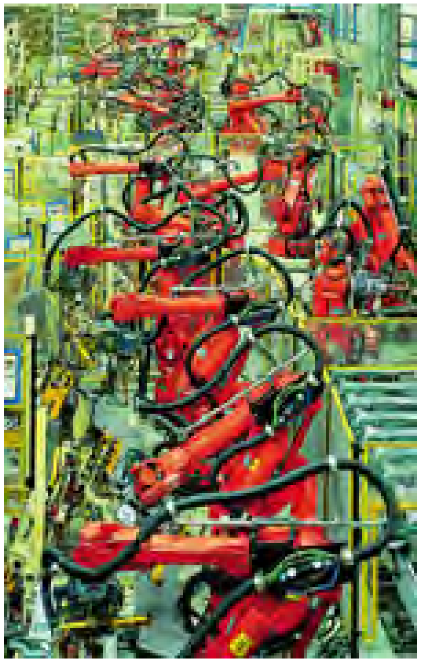
ABB's Organizational Structure



Organizational Structure of ABB

- Power Technologies Segment
  - Power Systems
  - Medium-Voltage Products
  - High Voltage Products
  - Transformers
  - Utility Automation Systems

- Automation Technologies Segment
  - Automation Products
  - Manufacturing Automation
  - Process Automation



ABB

ABB's Products

- Power Products
- Power Systems

ABB's Products

- Automation Products
- Process Automation
- Robotics



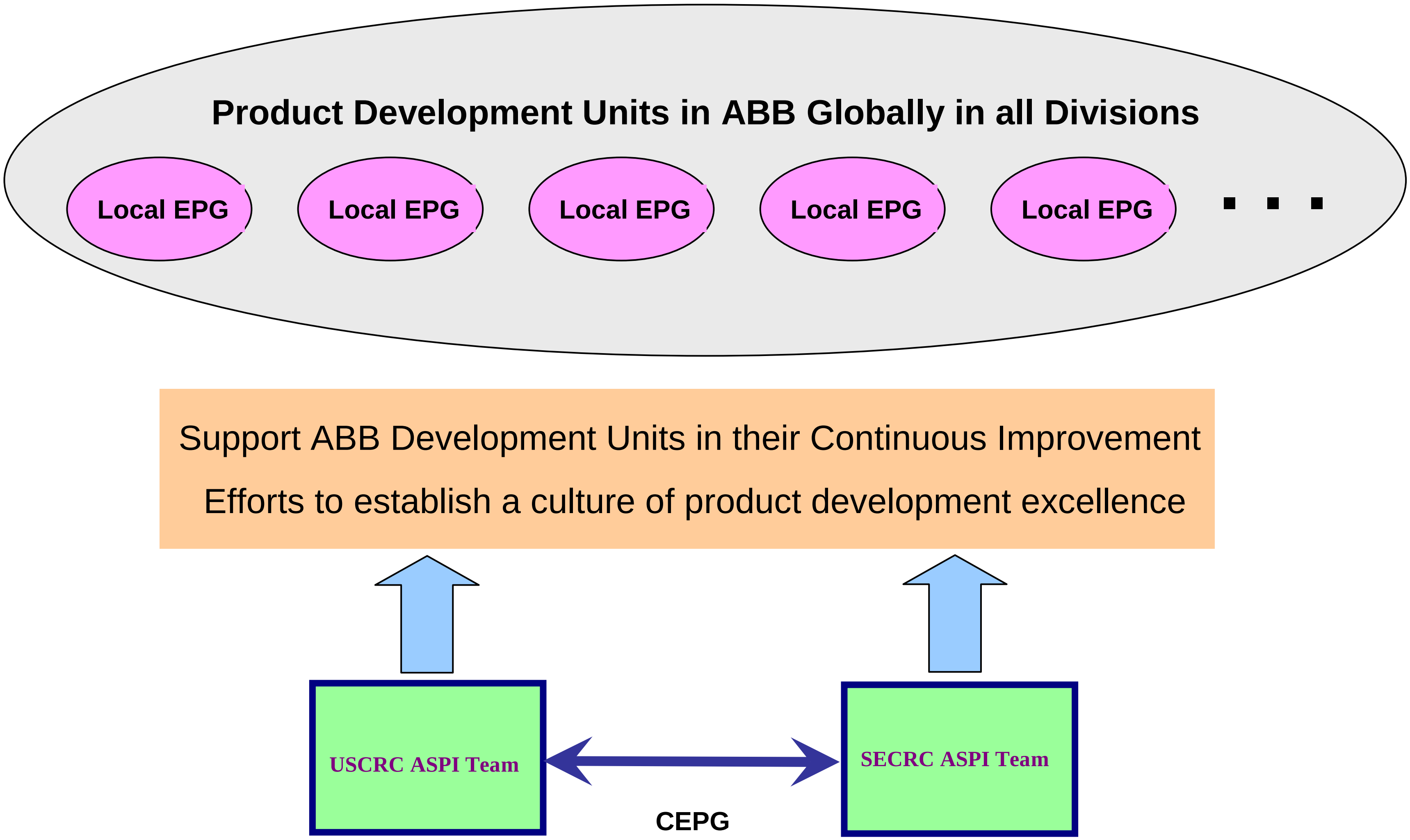


ASPI ABB SOFTWARE PROCESS INITIATIVE

- ABB Software Process Initiative (ASPI) acts as the Corporate Engineering Process Group
- ASPI is composed of members from 2 ABB Corporate Research Centers (CRCs):
  - United States: Raleigh
  - Sweden: Vasteras
- Responsible for:
  - Initiation activities
  - Performance of appraisals
  - Development of improvement methodologies,
  - Evaluation and deployment of pilots within ABB for CMMI transition, PSP/TSP, etc.
  - Assisting units in establishing improvement plans and acting
  - Collect lessons learned from process improvement activities

ABB

ABB Corporate EPG Support



Continuous Process Improvement Cycle

- Initiate Improvement activity
  - Define Medium/Long-term Strategic Improvement Plan (SIP) and identify organization’s business goals
- Conduct internal CMMI Appraisal (Class B)
- Develop Process Improvement Plan (PIP)
  - Prioritize process improvement activities using Business Objectives
- Implement PIP
- Monitor ROI
- Re-Initiate

Results of Internal ABB Class B CMMI Appraisal

- Establishes a baseline in the organization
- Serves as a basis to identify process improvement activities
- Recommended to include the Measurement and Analysis Process Area

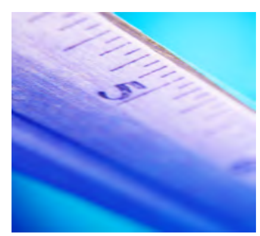
Practice	RD	ReqM	PP	PMC	MA	SAM	Ver	PPQA	CM
Specific Goal 1									
SP 1.1	Medium	Medium	High	High	High	High	High	High	High
SP 1.2	High	Medium	High	High	High	High	High	High	High
SP 1.3		High	High	High	High	High	High		High
SP 1.4		High	High	High	High				
SP 1.5		High		High					
SP 1.6				High					
SP 1.7				High					
Specific Goal 2									
SP 2.1	High		Medium	Medium	High	High	High	High	High
SP 2.2	High		High	High	High	High	High	High	High
SP 2.3	High		High	High	High	High	High		
SP 2.4			High		High	High			
SP 2.5			Medium						
SP 2.6			High						
SP 2.7			High						
Specific Goal 3									
SP 3.1	Medium		High				High		High
SP 3.2	Medium		High				High		High
SP 3.3	High		High						
SP 3.4	High								
SP 3.5	Medium								
Generic Goal 2									
GP 2.1	High	Medium	High	High	High	High	High	High	High
GP 2.2	Medium	High	High	High	High	Medium	High	High	High
GP 2.3	Medium	Medium	Medium	Medium	High	Medium	High	High	Medium
GP 2.4	High	High	High	High	High	Medium	Medium	High	High
GP 2.5	Medium	Medium	Medium	Medium	High	Medium	Medium	High	High
GP 2.6	Medium	High	High	High	High	Medium	High	High	Medium
GP 2.7	Medium	Medium	Medium	Medium	High	Medium	Medium	High	Low
GP 2.8	High	High	High	High	High	High	High	High	High
GP 2.9	High	High	High	High	High	High	High	High	High
GP 2.10	Low	Low	Low	Low	High	Low	Low	High	Low

GQM Definitions

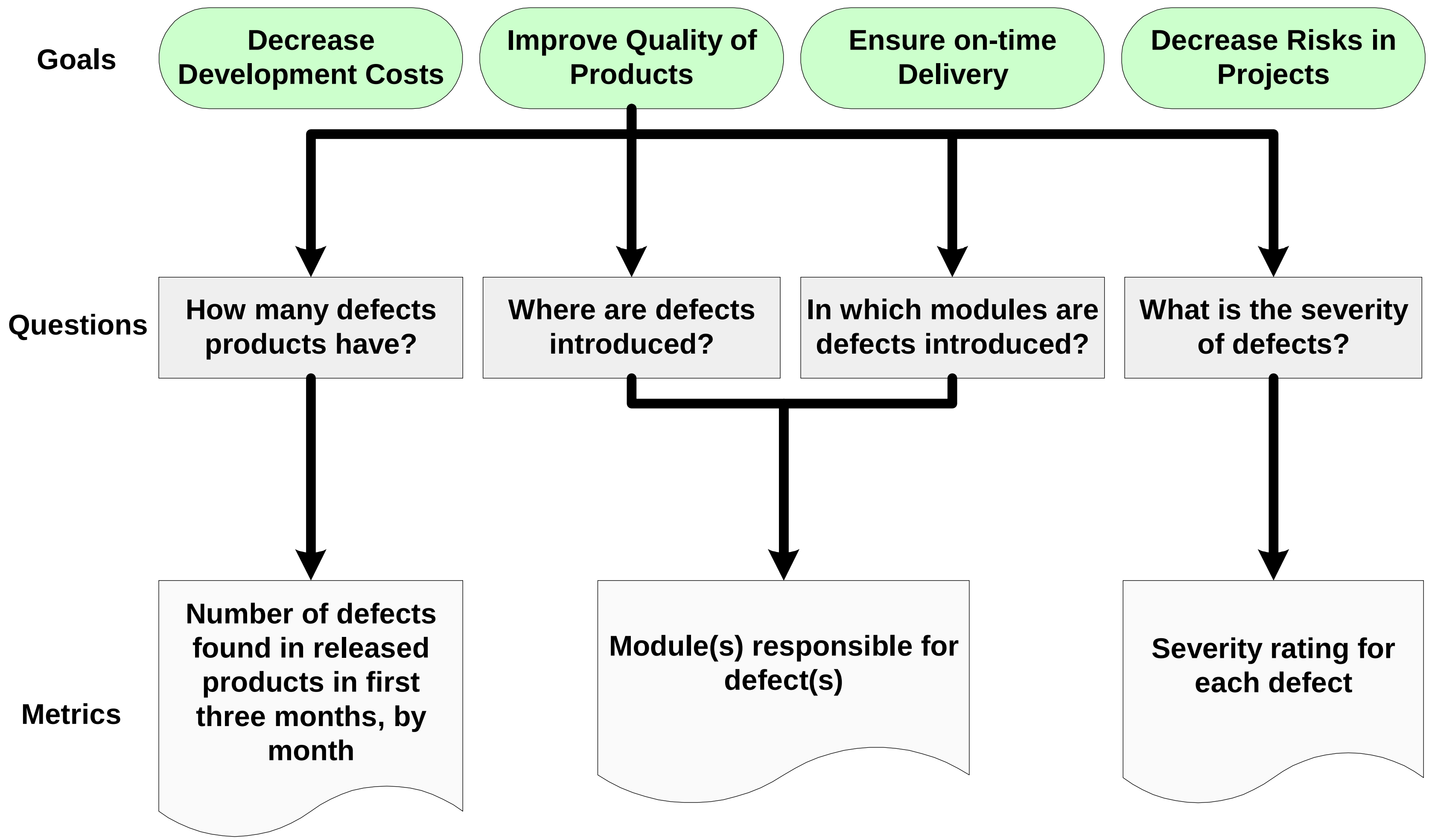
- Define major goals of the process improvement activity

- Questions derived from goals that must be answered to determine if the goals are achieved

- Measurements that provide the most appropriate information for answering the identified questions



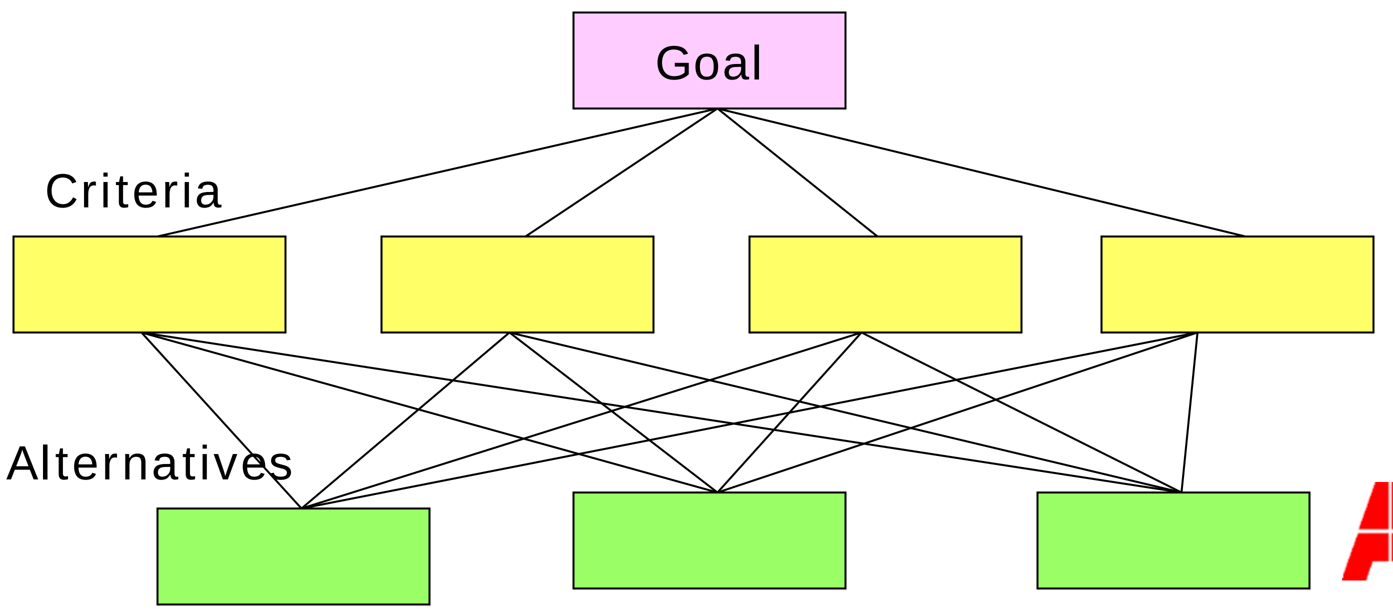
Example of GQM for Process Measurement



Using Analytical Hierarchy Process (AHP)*

- AHP provides a way to prioritize alternatives to satisfy an organization's business goals
- It represents a decision-making problem in hierarchical structure and consists of:
  - A business goal
  - Criteria to satisfy the business goal
  - Alternatives to select to achieve the business goal
- The GQM approach can be used to derive tree in AHP

* Golden, B. L., E.A. Wasil, P.T. Harker, "The Analytic Hierarchy Process", Springer-Verlag, 1989



AHP Steps

1. Setup criteria from cause of defects
2. Setup alternatives from specific practices
3. Assign weights to criteria
4. Perform pair-wise comparisons of alternatives for each criterion
5. Determine the priority of alternatives

Discussion of an Example at ABB

To follow Example please refer to provided handouts

Determine Goal

- Reduce the Cost of Poor Quality

    - Reduce the number of defects found at Integration Testing stage

        - Reduce rework time

            - Reduce cost associated with rework time by $150 kUSD

Step 1: Set Up Criteria

- Couple of salient known recent issues to the organization include:
  - There have been issues with capturing and managing requirements properly – this issue has been noticed especially when requirements have been provided to supplier
  - Quality with primary software sub-contractor has been a problem lately as well
- Criteria then are developed
  - Supplier agreements do not always reflect requirements
  - Requirements not properly defined
  - Requirements not properly managed

ABB

. . . Step 1: Set Up Criteria

- Table of criteria

Criteria
Supplier Agreements do not always reflect requirements
Requirements not properly defined
Requirements not properly managed

Step 2: Set Up Alternatives

- From the appraisal conducted, the PAs identified at the site as "defect generation responsible" include:
  - RD, REQM, SAM, VER, and CM
- With the above issues in mind, and the appraisal results identified, the PAs that contribute most to the criteria identified are established:
  - SAM, RD, and REQM
  - MA will be a "must"

Practice	RD	ReqM	PP	PMC	MA	SAM	Ver	PPQA	CM
Specific Goal 1									
SP 1.1	Medium	Medium	High	High	High	High	High	High	High
SP 1.2	High	Medium	High	High	High	High	High	High	High
SP 1.3		High	High	High	High	High	High		High
SP 1.4		High	High	High	High				
SP 1.5		High		High					
SP 1.6				High					
SP 1.7				High					
Specific Goal 2									
SP 2.1	High		Medium	Medium	High	High	High	High	High
SP 2.2	High		High	High	High	High	High	High	High
SP 2.3	High		High	High	High	High	High		
SP 2.4			High		High	High			
SP 2.5			Medium						
SP 2.6			High						
SP 2.7			High						
Specific Goal 3									
SP 3.1	Medium		High				High		High
SP 3.2	Medium		High				High		High
SP 3.3	High		High						
SP 3.4	High								
SP 3.5	Medium								
Generic Goal 2									
GP 2.1	High	Medium	High	High	High	High	High	High	High
GP 2.2	Medium	High	High	High	High	Medium	High	High	High
GP 2.3	Medium	Medium	Medium	Medium	High	Medium	High	High	Medium
GP 2.4	High	High	High	High	High	Medium	Medium	High	High
GP 2.5	Medium	Medium	Medium	Medium	High	Medium	Medium	High	High
GP 2.6	Medium	High	High	High	High	Medium	High	High	Medium
GP 2.7	Medium	Medium	Medium	Medium	High	Medium	Medium	High	Low
GP 2.8	High	High	High	High	High	High	High	High	High
GP 2.9	High	High	High	High	High	High	High	High	High
GP 2.10	Low	Low	Low	Low	High	Low	Low	High	Low

. . . Step 2: Set Up Alternatives

- From the PAs identified as most likely contributors to the criteria, and referring to the findings after the appraisal was conducted, the description of recommendations associated with specific practices of the PAs identified are presented as shown in this slide

Practices	Description of Alternatives
RD SP1.1-1, -2	Consistently elicit and document customers needs and expectations
RD SP 1.2	Consistently develop and document MRS
RD SP2.1	Consistently document ERS and establish link between ERS and MRS
RD SP3.2	Consistently establish and maintain definition of required functionality in ERS
RD SP 3.3	Analyze completeness and sufficiency of requirements ina consistent fashion
RD SP 3.5	Consistenlty validate product requirements
RM SP1.4	Establish and maintain bi-directional traceability
RM SP1.5	Identify and document inconsistencies between work products and requirements
SAM SP1.2	Select Suppliers based on their ability to satisfy requirements
SAM SP 2.1	Review COTS products to ensure they satisfy requirements
SAM SP2.3	Accept acquired product verifying it meets requirements

Step 3: Assign Weights to Criteria

- Weights are assigned to the criteria identified in Step 1 and they are prioritized accordingly

Criteria	Weight
Requirements not properly defined	0.5
Supplier Agreements do not always reflect requirements	0.3
Requirements not properly managed	0.2

ABB

Step 4: Pair-wise Comparison of Alternatives for each Criteria

- Using the AHP method, and considering the criteria, selected PAs, and observations, a prioritization of practices per criteria is performed.
- Prioritization for “Requirements not properly defined criteria are shown below

Ranking for "Requirements not properly Defined"		
Practices	Description	Priority
RD SP 1.2	Consistently develop and document MRS	0.41
RD SP2.1	Consistently document ERS and establish link between ERS and MRS	0.32
RD SP3.2	Consistently establish and maintain definition of required functionality in ERS	0.1
RD SP1.1	Consistently elicit and document customers needs and expectations	0.07
RD SP 3.5	Consistenlty validate product requirements	0.06
RD SP 3.3	Analyze completeness and sufficiency of requirements ina consistent fashion	0.04

Step 5: Calculate Priority and Expected Economic Impact

- After prioritizing alternative solutions by criteria, the method allows to prioritize all alternatives analyzed.

Practices	Description of Alternatives	Priority	Estimated Cost Reduction
RD SP 1.2	Consistently develop and document MRS	0.22	$33,000.00
RD SP2.1	Consistently document ERS and establish link between ERS and MRS	0.17	$25,500.00
RD SP3.2	Consistently establish and maintain definition of required functionality in ERS	0.15	$22,500.00
RD SP1.1	Consistently elicit and document customers needs and expectations	0.11	$16,500.00
RD SP 3.5	Consistenlty validate product requirements	0.09	$13,500.00
RD SP 3.3	Analyze completeness and sufficiency of requirements ina consistent fashion	0.08	$12,000.00
RM SP1.5	Identify and document inconsistencies between work products and requirements	0.07	$10,500.00
SAM SP1.2	Select Suppliers based on their ability to satisfy requirements	0.05	$7,500.00
SAM SP2.3	Accept acquired product verifying it meets requirements	0.03	$4,500.00
RM SP1.4	Establish and maintain bi-directional traceability	0.02	$3,000.00
SAM SP 2.1	Review COTS products to ensure they satisfy requirements	0.01	$1,500.00
	Total	1	$150,000.00

Questions ?

Raytheon
Customer Success Is Our Mission

Wasted Days and Wasted Nights

-Leveraging Your Appraisal Team As A Resource –

November 16, 2005

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SCAMPI – An Evidence Collectors View

Raytheon
Missile Systems

The Scene Opens With The Clock Nearing Midnight

- Evidence collectors are frantically trying to finish up the task of putting representative evidence into the Process Implementation Indicator database before the Appraisal Team arrives on Monday.

- One of the evidence collectors blurts out "The Appraisal Team has been here twice now and they keep saying the same thing:"

"These rocks are no good, go get a different set of rocks"

SCAMPI – An Appraisal Team's View

Raytheon
Missile Systems

<u>The Scene Opens with the Clock Nearing Midnight</u>

- The Appraisal Team is trying to dig through the contents of the PII data base and trying to make some sense of how the evidence is representative of the process areas being reviewed.

- A member of the Appraisal Team blurts out in frustration:

> "When are these guys going to learn to simply give us what we asked for ???"

What's the Problem?

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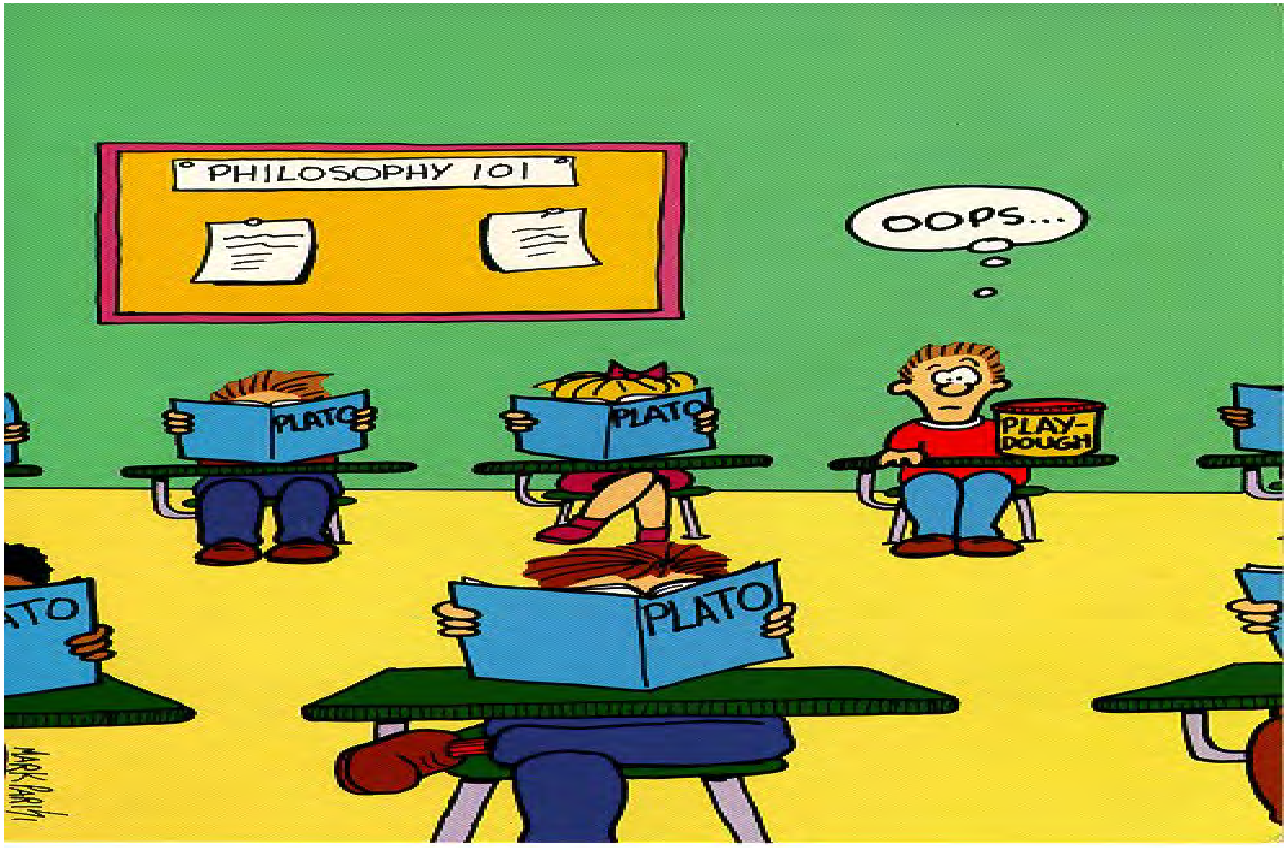

The problem is the disconnects that occur between the Appraisal Team and the Evidence Collectors

Knowledge Expectations Communication

Disconnect # 1 - Knowledge

Raytheon
Missile Systems

- **ATM's have knowledge of model and application to real process**
  - Not just book knowledge
  - Often has limited knowledge of Site specific culture and program unique implementations
  - May not have sufficient knowledge on how to interpret the artifacts
- **Evidence collector has knowledge of program and site processes**
  - Not necessarily a SCAMPI Methodology expert
  - May not be fluent in *CMMI-ese*
  - May not have sufficient knowledge to interpret the model as it relates to program artifacts

Disconnect #2 - Expectations

- **ATM expect evidence and comments (PIID) to tell the story of how the programs have instantiated the process**
  - Expects to be in verification, not discovery!
  - Expects evidence to be relevant, concise and sufficient
- **Evidence collector's expect implicit details on what is needed to satisfy the model**
  - Expects detailed feedback on SCAMPI results
  - Expects consistency from appraisal type to appraisal type and from mini-team to mini-team

Disconnect # 3 - Communications

Raytheon Missile Systems

- **ATM's know the vocabulary in the CMMI and are influenced by their unique experiences**.
  - Tend to communicate with model jargon
  - Assume others have same knowledge or thoughts
- **Evidence collector knows the vocabulary of their site, and have a varying knowledge of CMMI vocabulary**.
  - Tend to communicate in terms of local or program process and then try to relate to CMMI speak
  - Do not instinctively know what to do with CMMI phrases such as "For at least one program, insufficient evidence was provided"

Symptoms of the "Disconnect" Disease

Raytheon
Missile Systems

- Wasted calendar time and dollars
- Long hours
- Too much evidence collected (Quantity not Quality)
- Frustrated ATMs, Evidence Collectors, Sponsors
- Unnecessary reviews
- Poor appraisal results

Raytheon Missile Systems

Exploring the Fixes

Option 1 - Send everybody to appraisal training

- Expensive$$$$$
- Results in “Book Learned” knowledge

Option 2 - Use previous ATMs as evidence collectors.

- Limited availability (they have real jobs too)
- Minimal knowledge carryover into the appraisal

Option 3 - Leverage off the knowledge and experience of existing ATMs

- **<u>Hmmm, sounded promising !!!!!</u>**

Facing Realities

Raytheon
Missile Systems

- Need to develop a mechanism/process to bridge the disconnects between the ATM, Evidence collectors, and project personnel.
- Need to provide an environment where knowledge and expectations can be openly shared
- Must mitigate the typical communication problems by eliminating the communication bottlenecks.

↓

SHOULDER-TO-SHOULDER REVIEWS

Raytheon Missile Systems

Shoulder-To-Shoulder Reviews

- Current ATM's working with EC and Project personnel "shoulder-to-shoulder"
- Open, honest, two-way dialog to hammer out and understanding of what is expected by the model, what the program produces, and then what is missing
  - Match up model expectations/terminology with how the program operates and then tell the story
- Sufficient time allocated for iterative reviews prior to next "appraisal"
- NOT for the sponsor or management
- Care needs to be taken to separate "church and state"

Results Achieved

- **Achieved what appeared to be un-achievable (based on the schedule)**
- **Reduced/Eliminated:**
  - Pre-Appraisal Panic
  - Levels of Frustration on all side
  - Wasted calendar time and dollars
  - Quantity of evidence collected
  - Quantity of INFO requests
  - Unnecessary reviews
- **Improved:**
  - Model knowledge of the programs and EC
  - ATM understanding of the program's implementation and issues
  - EC and Project understanding of ATM issues and concerns.
  - Quality of evidence (not quantity)
  - Quality of the question and answer sessions.
  - Results of Appraisals

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Missile Systems

Shoulder-to-Shoulder Lessons Learned

- Do not assume the other person knows
- S2S outcome is not a management presentation
- S2S output must be given to programs and is focused at the program level
- Adequate time must be give for S2S, 4 hours per PA (SP’s only) was our average
- Golden artifacts aren’t really golden, more like bronze
- Iterative S2S with same people

Raytheon Missile Systems

Evidence Collector Survey Results

“How affective was communications between you and the appraisal team before and after Shoulder-to-Shoulder?”

<u>BEFORE:</u>

“It was done with written requests through a bottleneck…. The (ATMs) were those ignorant boobs sequestered from the real world in some room full of computers”

<u>AFTER:</u>

“At first I thought S2S reviews were silly and tedious; now I wish they had been done even sooner !”

“I think S2S really helped us to clarify what the Appraisal Team was looking for…what and how they interpreted the model”

“I would say that the S2S is an indispensable component of a successful appraisal”

QUESTIONS?

RECP

Raytheon

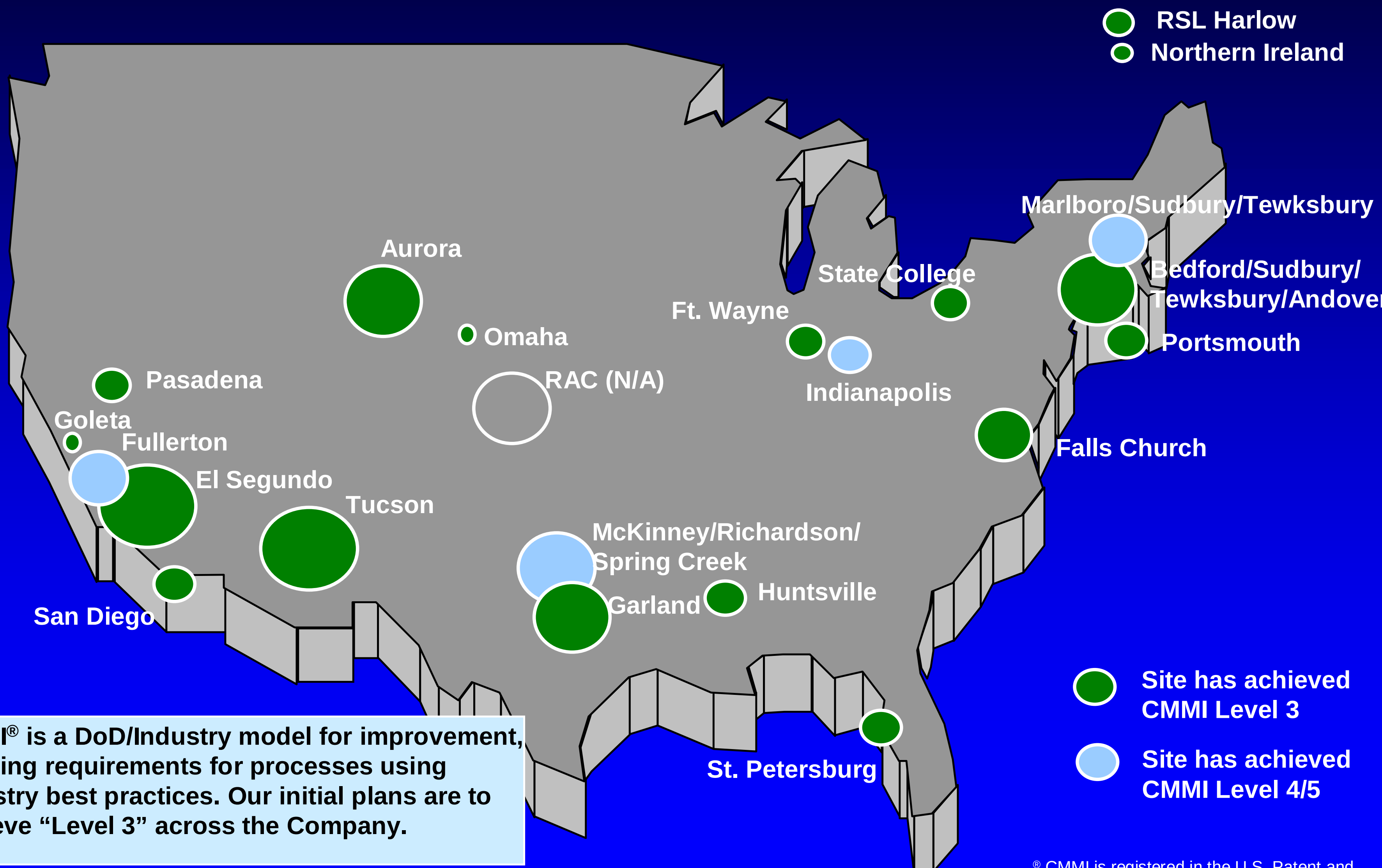
Customer Success Is Our Mission

How Has CMMI Improved Our Program & Project Performance – A Raytheon Perspective

John H. Evers, D.Engr.
Raytheon Processes PM
15 November 2005

CMMI®
Current Status by Site

Raytheon



CMMI® is a DoD/Industry model for improvement, defining requirements for processes using industry best practices. Our initial plans are to achieve "Level 3" across the Company.

® CMMI is registered in the U.S. Patent and Trademark Office by Carnegie Mellon University

Raytheon Process Environment

Raytheon
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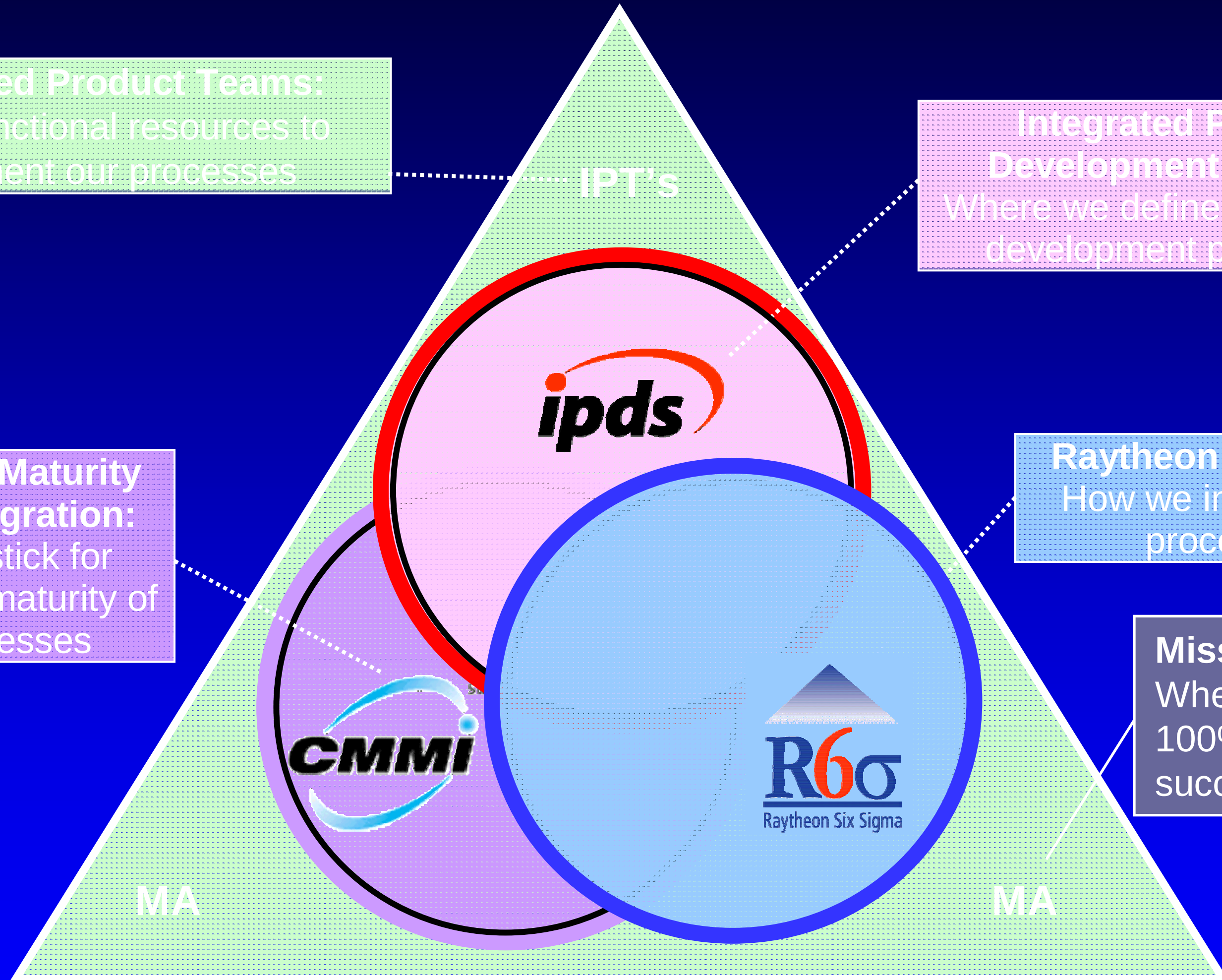
Integrated Product Teams: Cross-functional resources to implement our processes

Integrated Product Development System: Where we define our product development processes



Capability Maturity Model Integration: The yardstick for judging the maturity of our processes

Raytheon Six Sigma: How we improve our processes

Mission Assurance: Where we define 100% customer success

Start with a common process (IPDS), assess yourself against the process using CMMI and continually improve the process using Raytheon Six Sigma

RECP

Improvement Observations

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- Greatest benefits from improved processes on programs using those processes from the start
  - Deployment to new starts (or equivalent) vital
  - Joint stake with customers to maximize benefits
  - Limited to no benefits to existing programs
- Many development programs multi-year efforts; time needed to see ultimate benefits
- Primary benefit of Level 3 is stabilization in processes, increased consistency in program execution; greater benefits with Level 4 / 5

Benefits take time to accrue

RECP

Raytheon
Customer Success Is Our Mission

Raytheon's Position

- Committed to using CMMI as the primary model for process improvement
  - Moving towards Level 5 across nearly all businesses
  - Connected to our business objectives
- Seeking improved processes so we can deliver better products and solutions to our customers
  - Know it's not an "overnight journey"; we're in this for the long haul

Emphasis on Continual Improvement

RECP

Raytheon

Customer Success Is Our Mission

Carnegie Mellon
Software Engineering Institute

Pittsburgh, PA 15213-3890

Measuring Performance:
Evidence about the Results of CMMI®

Dennis R. Goldenson
Diane L. Gibson
Software Engineering Institute

5th Annual CMMI Technology Conference & User Group
Denver; November 2005

Sponsored by the U.S. Department of Defense

Today's Talk

- Measuring Performance: Why Care? What Counts?
- Summary of existing results
- More detailed results: Maturity Levels 2 & 3
- More detailed results: High Maturity
- Current Directions

Why Measure Performance Outcomes of CMMI?

Initially ...

- To verify that the there was value in beginning to use CMMI, in comparison to the SW-CMM

Over the more recent period ...

- To provide ongoing objective evidence about the value of CMMI

In general:

- To support evidentially based continuous process improvement

Why Objective Evidence?

Trustworthy Evidence is Essential for:

- Addressing skepticism about the benefits of any model-based process improvement
- Demonstrating the value of CMMI over its source models

But also for:

- Building commitment & obtaining resources
- Providing input to improve processes & technologies
- Comparing results with other organizations
- Enhancing quantitative management
- Informing the development & evolution of the CMMI Product Suite

What is Legitimate Evidence?

Measured performance results due to:

- Adoption or upgrade to CMMI
- Systems engineering & other “new” model content
- Broadened organizational scope across disciplines
  - Especially integration of software & systems
- Maturity or capability improvement initiatives
  - Comprehensive or selected processes
- Improvement in areas originally defined by the SW-CMM

They’re all pertinent … just different

- It depends on your purpose which ones are of interest
- Be careful to specify your purposes…

What Does it Mean to “Implement” CMMI?

An organization’s processes are <u>not</u> the same as model processes!

- Organizational units implement & institutionalize processes for many reasons
  - Often based on multiple sources & perspectives
- Processes based on the same model can differ widely
- Processes are implemented to achieve different goals and outcomes

Questions:

- Can we expect to find common measures of performance?
- When do we need the common measures?

Are Quantitative Results Enough?

Need more context to make the quantitative results meaningful

- Can we do that without revealing proprietary or other sensitive information?

Need enough detail to describe what was done:

- What improvements have been made?
- Why were these improvements chosen?
- How are the results used?

Today’s Talk

Measuring Performance: Why Care? What Counts?

Summary of existing results

More detailed results: Maturity Levels 2 & 3

More detailed results: High Maturity

Current Directions

Reports & Tutorials

Demonstrating the Impact and Benefits of CMMI®: An Update and Preliminary Results, Special Report, CMU/SEI-2003-SR-009, Software Engineering Institute October 2003.

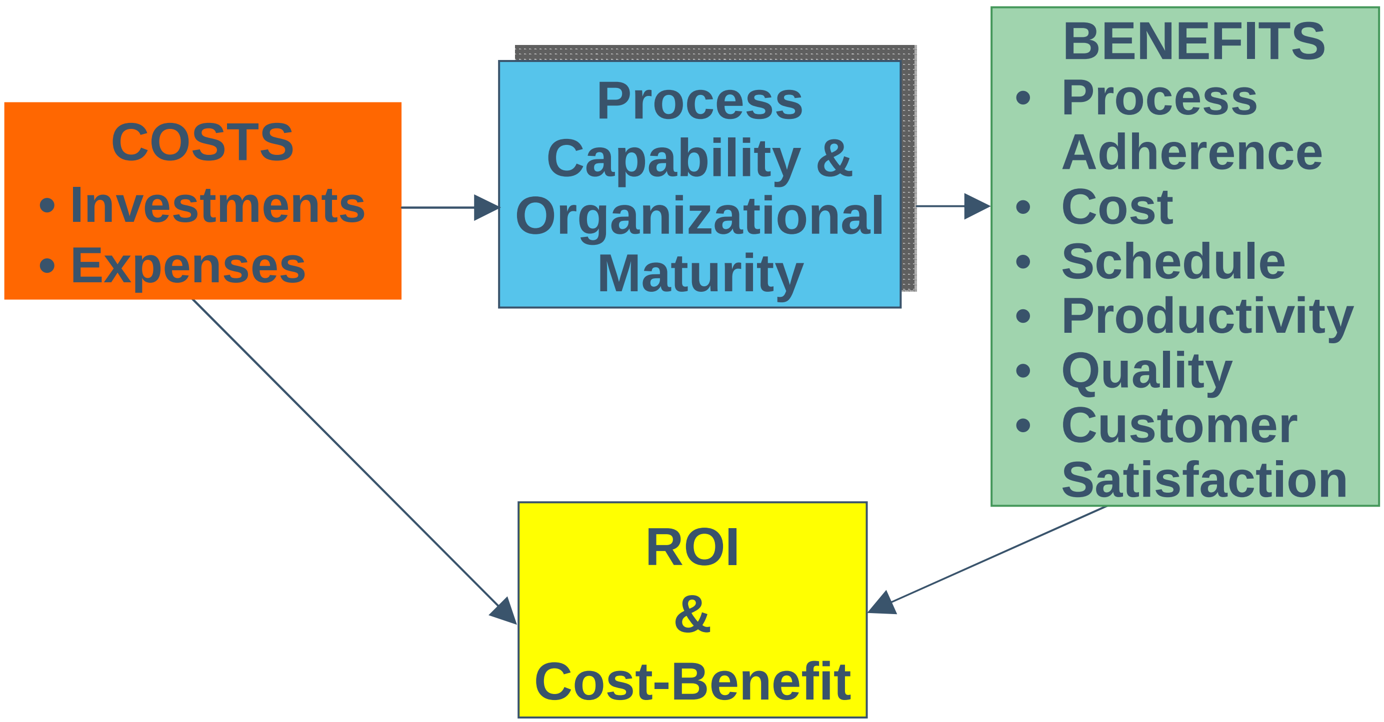
Conference presentations & posters

Tutorials:

- Guidance about scoping & calculating ROI analyses
- Processes & models for estimating ROI proactively

Benchmarking CMMI Cost and Impact: Interim Report, December 2004 (Distribution of full document limited to benchmark contributors.)

A Framework of Costs & Benefits



The Documented Results So Far

Evidence from

- Conference presentations
- Published papers
- Direct communication with the SEI

How Trustworthy?

- Public reports from appraised organizations
- Private communications
- Information reviewed by SEI technical staff

Results are drawn from 30 organizations

- Several of which are larger enterprises with more than one constituent organization

Performance Results Summary

Improvements	Median	# of data points	Low	High
Cost	20%	21	3%	87%
Schedule	37%	19	2%	90%
Productivity	67%	16	11%	255%
Quality	50%	18	29%	132%
Customer Satisfaction	14%	6	-4%	55%
Return on Investment	4.8 : 1	14	2 : 1	27.7 : 1

- N = 24, as of 9 November 2005
- Organizations with results expressed as change over time

Existing Measures and Bases for Comparison Differ: Some Caveats

Performance categories combine results from a wide variety of cases

- Ranging from pilot projects about the effects of particular processes
- To organization-wide improvement initiatives covering the full scope of CMMI

Other factors sometimes occur simultaneously with CMMI-based process improvement

- E.g., reuse, personnel changes or new technologies

Specific measures differ as well

- E.g., total cost or cycle time *versus* discrepancies between estimates & actuals

However…

Valid & valuable comparisons <u>can</u> be made

- So long as we distinguish properly among them

Varied cases & measures provide ample proof of concept

- About the potential of CMMI-based process improvement

The same results may not always be repeatable elsewhere

- But, we often see very impressive performance effects
- The probability is very low that such results are due to chance alone

Multi trait, multi method

Variety in measures: Cost

Measures included:

Reductions in

- costs
- cost of quality
- poor quality
- costs of rework
- cost of delivery accuracy
- defect find & fix costs
- variation in CPI
- overhead rate
- software unit costs
- #/cost of process staff

Savings in/due to

- implementing hardware processes

Improved

- budget estimation
- average CPI
- cost variance

Variety in measures: Schedule

Measures included:

Reductions in	**Improved/increased**
variation in schedule	average (SPI)
performance index (SPI)	estimation accuracy (III)
# of days late	schedule variance (II)
days variance from plan	% of milestones met
slippage of project delivery	cycle time (II)
schedule variance	

Variety in measures: More Examples$_1$

Productivity measured in, for example:

- ELOC per labor hour
- function point per FTE
- source statements per month
- testing
- # of releases per year
- comparisons between builds
- software production, in general

Quality measured in

- Defects (different products, stages of the life cycle)

Variety in measures: More Examples$_2$

Customer Satisfaction measured with

- Award fees
- Ratings

ROI

- Defects avoided
- Post-release defects avoided
- Automation
- Quality activities
- Process Improvement in general
- Maturity Level, in general

CMMI Performance Results Web Site$_1$

Results by: http://www.sei.cmu.edu/cmmi/results.html

- Performance category & organization
- Brief statements & graphical examples
- Full source documents

CMMI Performance Results Web Site$_2$

View by Organization

The performance results examples contain brief assertion statements and their sources and sometimes are accompanied by graphic illustrations. To view all examples for an organization, click the name of the organization.

Organization
Accenture
Anonymous 1
Anonymous 2
DB Systems GambH
Fire Support Software Engineering Division
General Dynamics Advanced Information Systems
General Motors
Harris Corporation
IBM Australia Application Management Services
JPMorgan Chase
Lockheed Martin Corporation
Lockheed Martin Management and Data Systems
Lockheed Martin Maritime Systems & Sensors – Undersea Systems
Lockheed Martin Maritime Systems and Sensors – Radar Systems
Lockheed Martin Maritime Systems and Sensors – Syracuse
Lockheed Martin Systems Integration
Motorola Global Software Group
NCR
Northrop Grumman IT, Defense Enterprise Solutions
Raytheon Corporation, Anonymous site
Raytheon Network Centric Systems
Raytheon North Texas Software Engineering
Reuters
SAIC System and Network Solutions Group
Siemens Information Systems Ltd.
Systematic Software Engineering
TATA Consultancy Services
Thales Air Traffic Management
The Boeing Company
Warner Robins

Carnegie Mellon
Software Engineering Institute

CMMI Performance Results Web Site$_3$

CMMI® Performance Results

IBM Australia Application Management Services

The performance results examples contain brief assertion statements and their sources and sometimes are accompanied by graphic illustrations. To view the graphic or source for a statement, click the View link.

Cost | Schedule | Productivity | Quality | Customer Satisfaction |

Cost

	Assertion Statement
View	On-budget delivery improved from over 90 percent to nearly 100 percent as the organization moved from SW-CMM maturity level 3 to CMMI maturity Level 5

top

Schedule

	Assertion Statement
View	On-time delivery remained well over 90 percent, with a slight improvement, as the organization moved from SW-CMM maturity level 3 to CMMI maturity level 5

top

Productivity

	Assertion Statement
View	$99 million dollars saved in development costs due to increased productivity as the organization moved from SW-CMM maturity level 3 toward CMMI maturity level 5
View	$103 million dollars saved in maintenance costs due to increased productivity as the organization moved from SW-CMM maturity level 3 toward CMMI maturity level 5
View	Over 20 percent improvement in account productivity as the organization moved from SW-CMM maturity level 3 toward CMMI maturity level 5

top

Quality

	Assertion Statement
View	40 percent reduction in all production problems as the organization moved from SW-CMM maturity level 3 toward CMMI maturity level 5
View	On average, over 95 percent of problems were closed monthly within the customer-specified time frame after the organization achieved CMMI maturity level 5
View	Over 80 percent reduction in Severity 1 problems as the organization moved from SW-CMM maturity level 3 toward CMMI maturity level 5

top

Customer Satisfaction

	Assertion Statement
View	Customer satisfaction remained well over 80 percent after the organization achieved CMMI maturity level 5

top

Example

CMMI Performance Results Web Site$_4$

CMMI® Performance Results

Assertion Statement Detail

Statement

Over 20 percent improvement in account productivity as the organization moved from SW-CMM maturity level 3 toward CMMI maturity level 5

Organization

IBM Australia Application Management Services

Graphic

Performance Measure: Productivity

Account Productivity (FP/FTE)

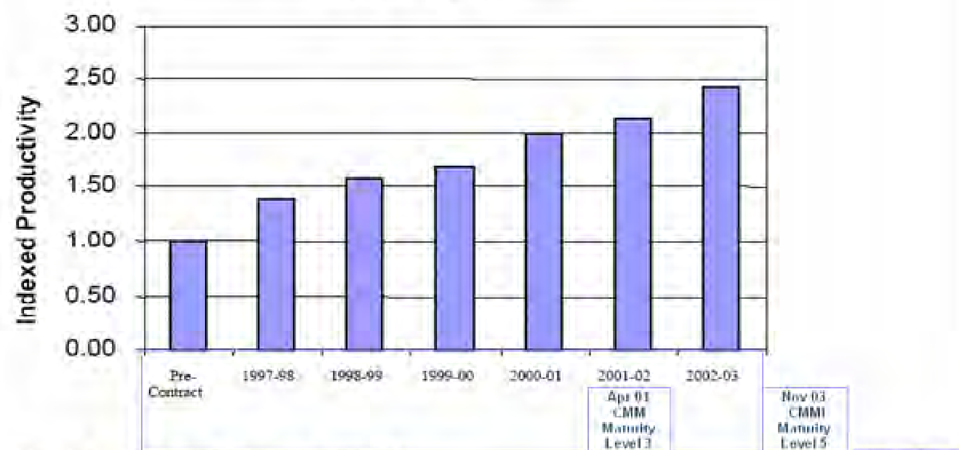


Figure 8: Account Productivity (FP/FTE)

Maturity Level Notation added by SEI

Source

View

IBM Australia Application Management Services. *Software Process Improvement Journey: IBM Australia Application Management Services.* A Report from the Winner of the 2004 Software Process Achievement Award (CMU/SEI-2005-TR-002). Nichols, Robyn & Connaughton, Colin. Pittsburgh, PA: Software Engineering Institute, Carnegie Mellon University, 2005.

Today's Talk

Measuring Performance: Why Care? What Counts?

Summary of existing results

☛ More detailed results: Maturity Levels 2 & 3

More detailed results: High Maturity

Current Directions

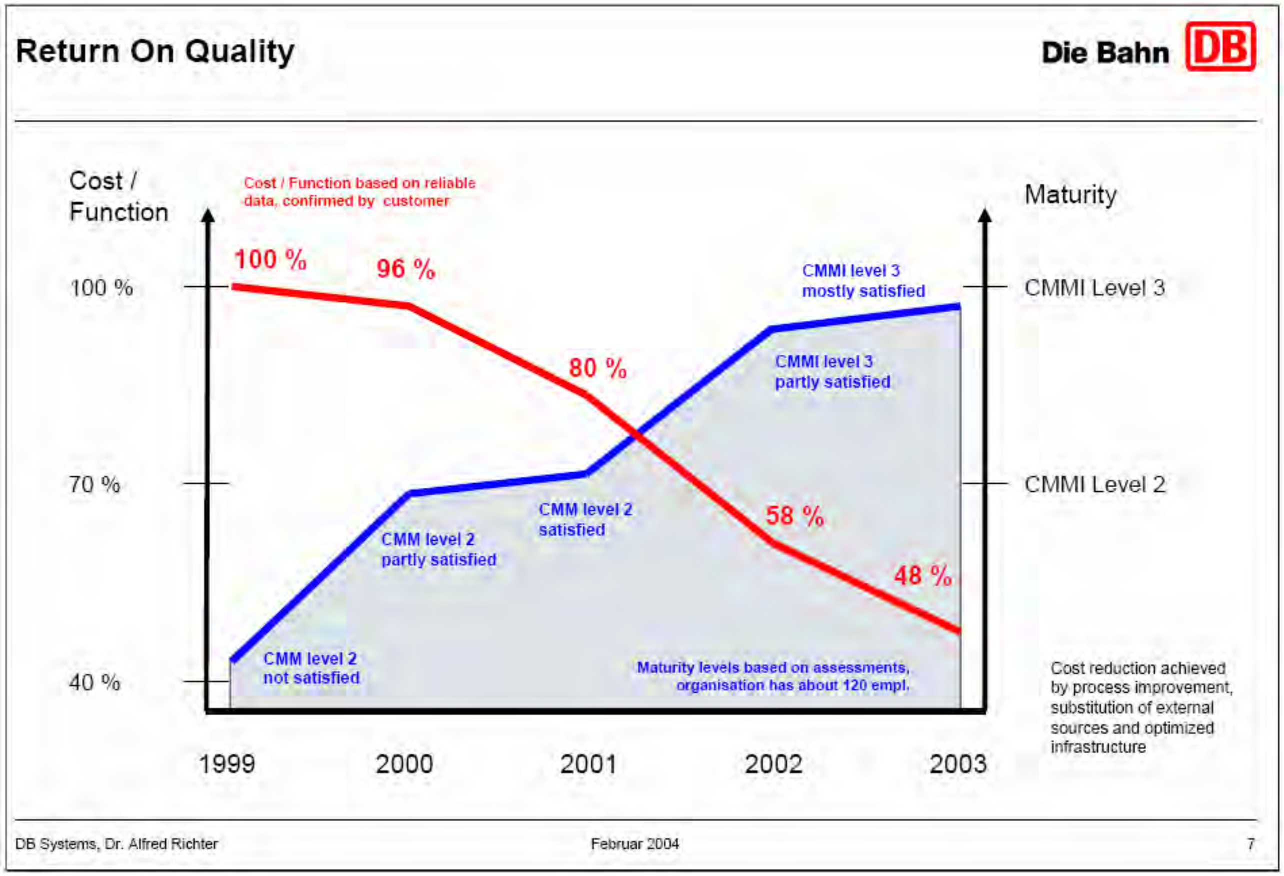
Statements, Organizations at ML 2 & 3[1]

Costs

- Reduced rework costs by 42% at CMMI Maturity Level 3 (Raytheon)
- $2.1 Million in savings in hardware engineering processes in an organization moving towards CMMI maturity level 3 (Anonymous)
- From a 1999 baseline prior to improvement, costs dropped 48% by 2003, as the organization moved toward CMMI ML3. (DB Systems GamBH)

Performance Measure: Cost

Costs dropped 48 percent from a baseline prior to SW-CMM ML2 as the organization moved toward CMMI ML3



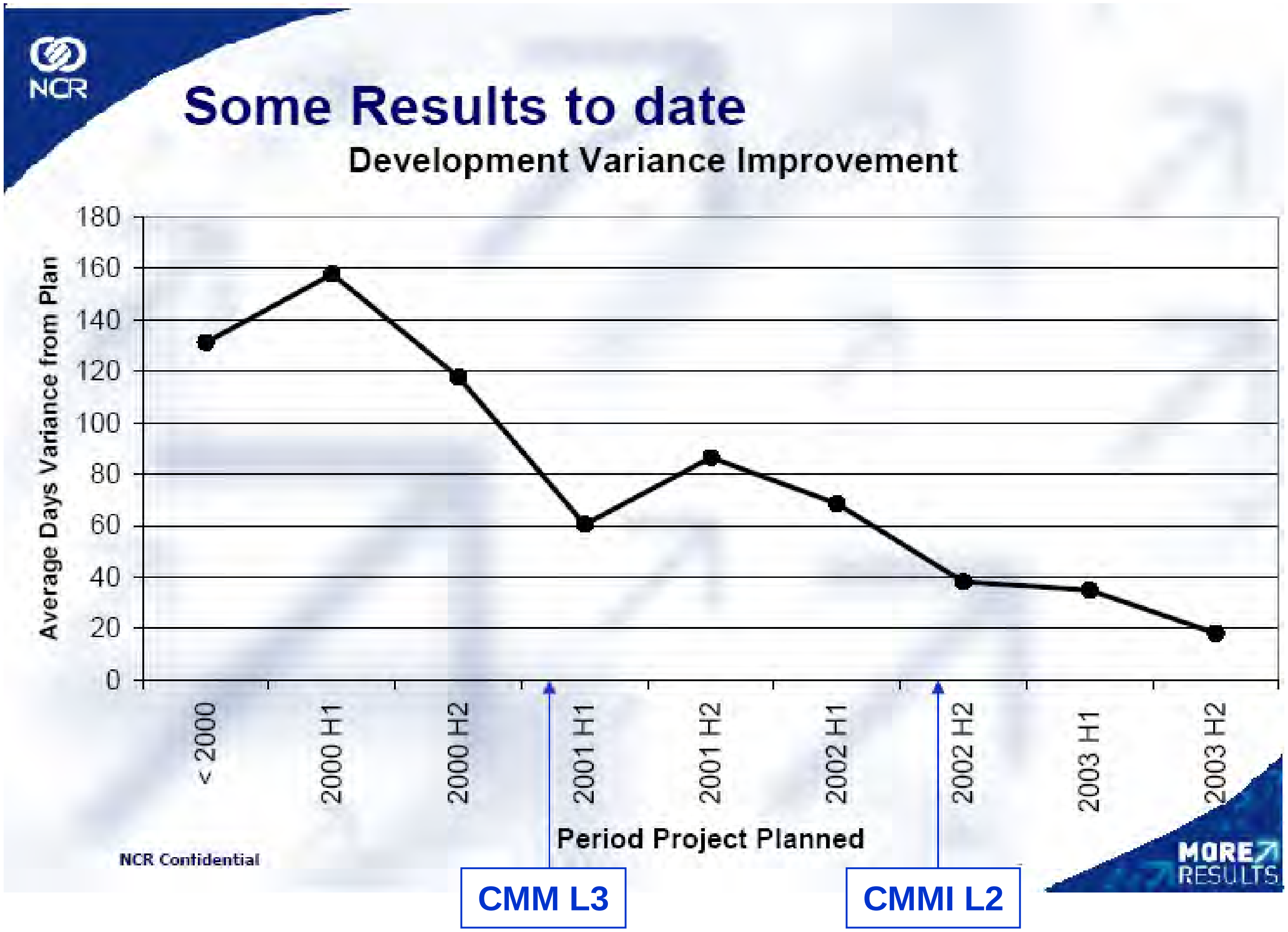
DB Systems GamBH

Statements, Organizations at ML 2 & 3_2

Schedule

- Percentage of milestones met improved from approximately 50% to approximately 85% following organization focus on CMMI (General Motors)
- Average variance from development plan reduced from approximately 60 days to less than 20 days one year after reaching CMMI Maturity Level 2 (NCR)
- Reduced schedule variance over 20 percent in an organization moving towards CMMI maturity level 3 (Anonymous)
- Increased through-put resulting in more releases per year at CMMI maturity level 3 (JP Morgan Chase)
- Achieved 95 percent on time delivery in an organization moving towards CMMI maturity level 3 (Anonymous)

Performance Measure: Schedule



Levels added by SEI

Statements, Organizations ML 2 & 3_3

Productivity

- Used Measurement & Analysis Process Area to realize an 11 percent increase in productivity, corresponding to $4.4M in additional value (Anonymous)

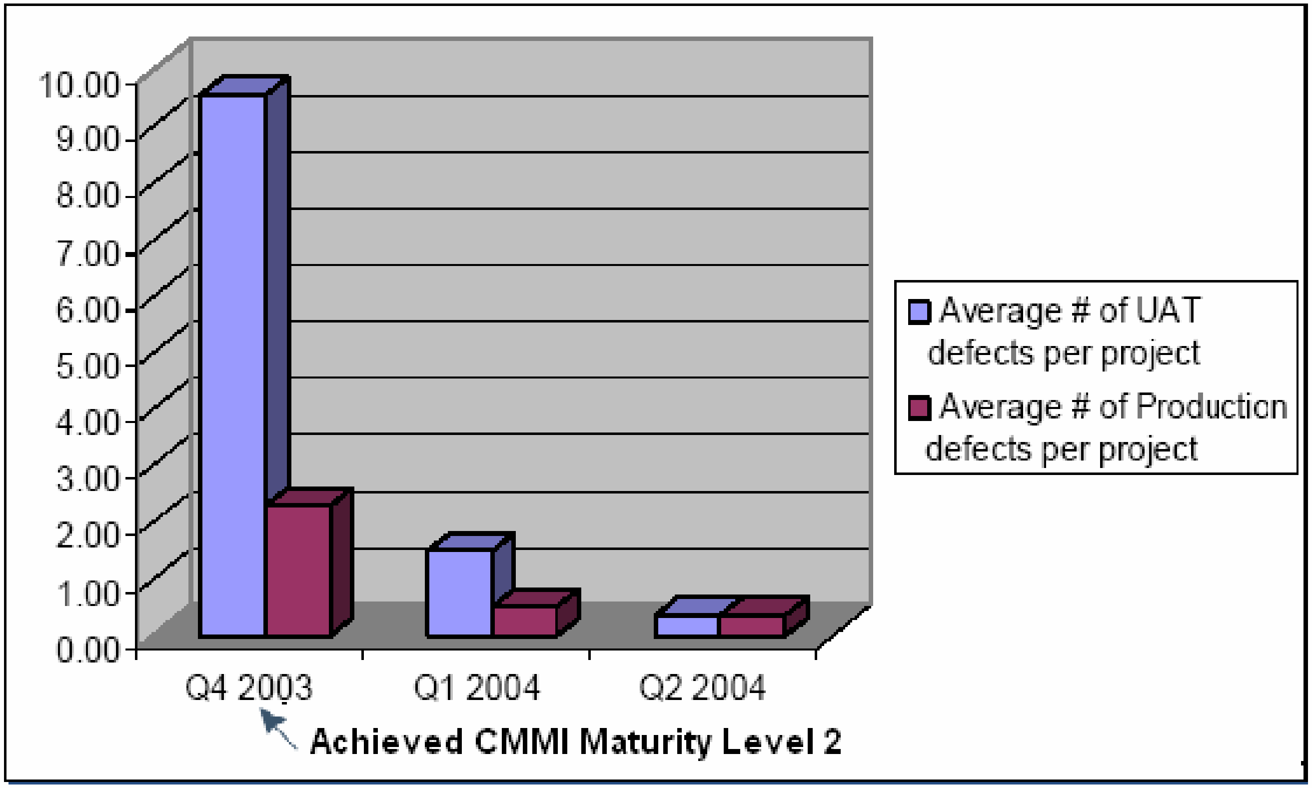
Quality

- Reduction in number and severity of post release defects at CMMI ML2 (Anonymous)
- More than 80% drop in defects in 6 months after achieving CMMI Maturity Level (JP Morgan Chase)
- 44% defect reduction following causal analysis cycle at an organization moving towards CMMI maturity level 3 (Anonymous)

CMMI ®

Performance Measure: Quality

Asia Treasury and Credit Rates achieved CMMI level 2 at the end of 2003. In the subsequent 6 months their average number of UAT & production defects dropped by more than 80% (18 projects)



JPMorgan
ibtechnology

Statements, Organizations at ML 2 & 3_4

ROI

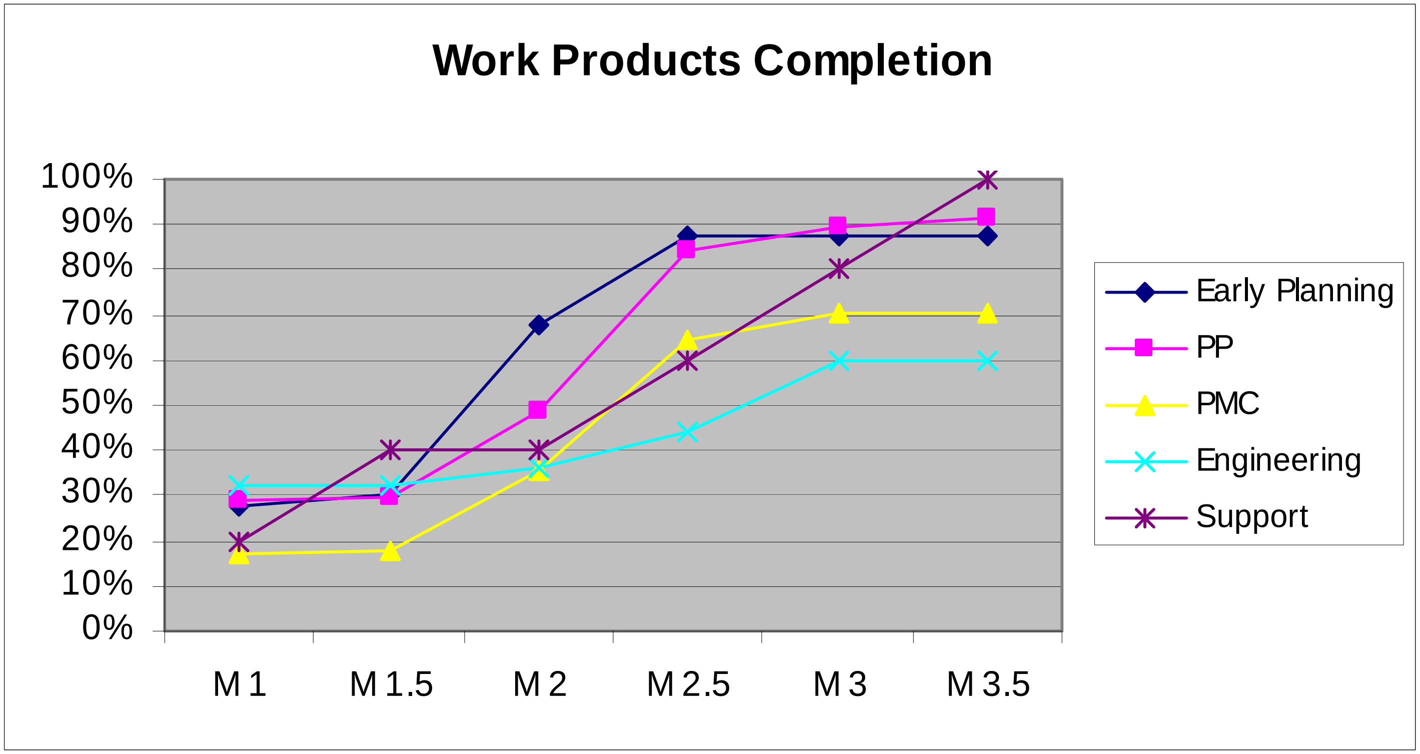
- Used Measurement & Analysis Process Area to realize a 2.5:1 ROI over 1st year, with benefits amortized over less than 6 months (Anonymous)

Process Adherence*

- Marked improvements in work product completion after new training instituted on the way to CMMI Maturity Level 3 (CMS Information Systems, Inc.)

* Evidence of this kind is crucial for a better understanding how process changes have been implemented. We have seen very little so far:

Progress during PI Effort



CMS Information Services, Inc.

Today’s Talk

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Current Directions

Performance Measure: Cost

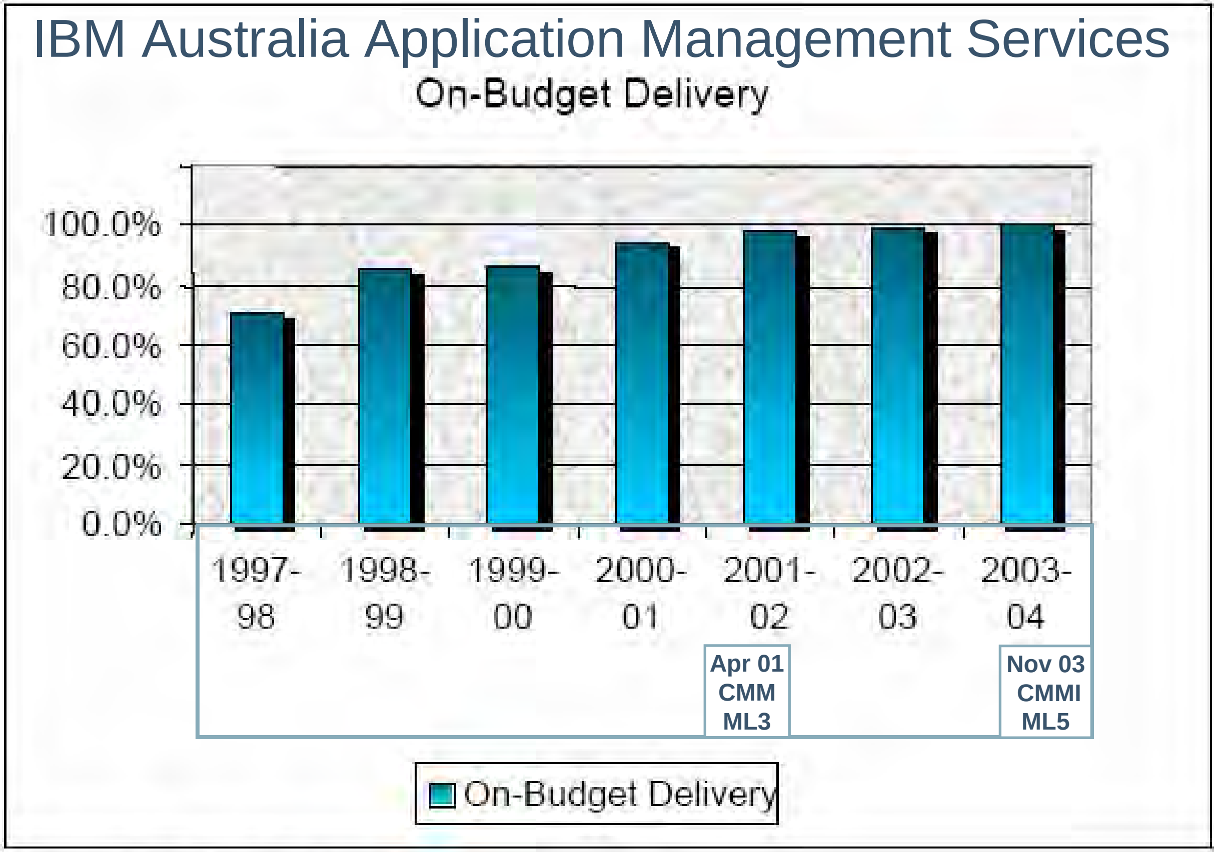


Figure 6: On-Budget Delivery

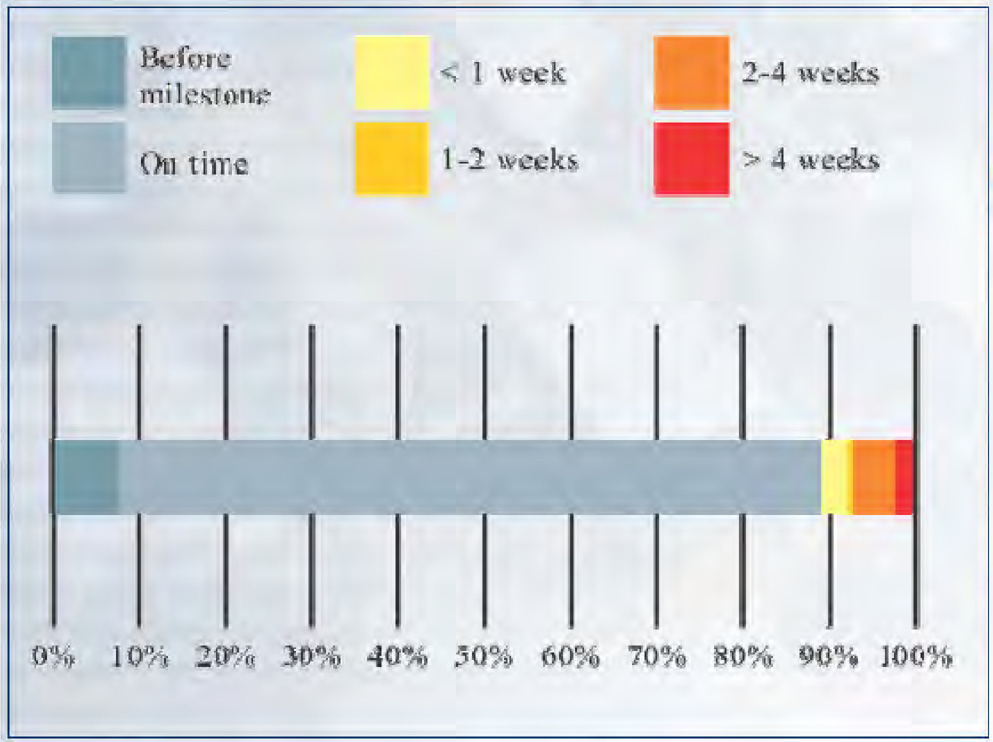
Maturity Level Notation added by SEI

Carnegie Mellon
Software Engineering Institute

CMMI ®

Performance Measure: Schedule

89% of all deliveries in 2003 were on time



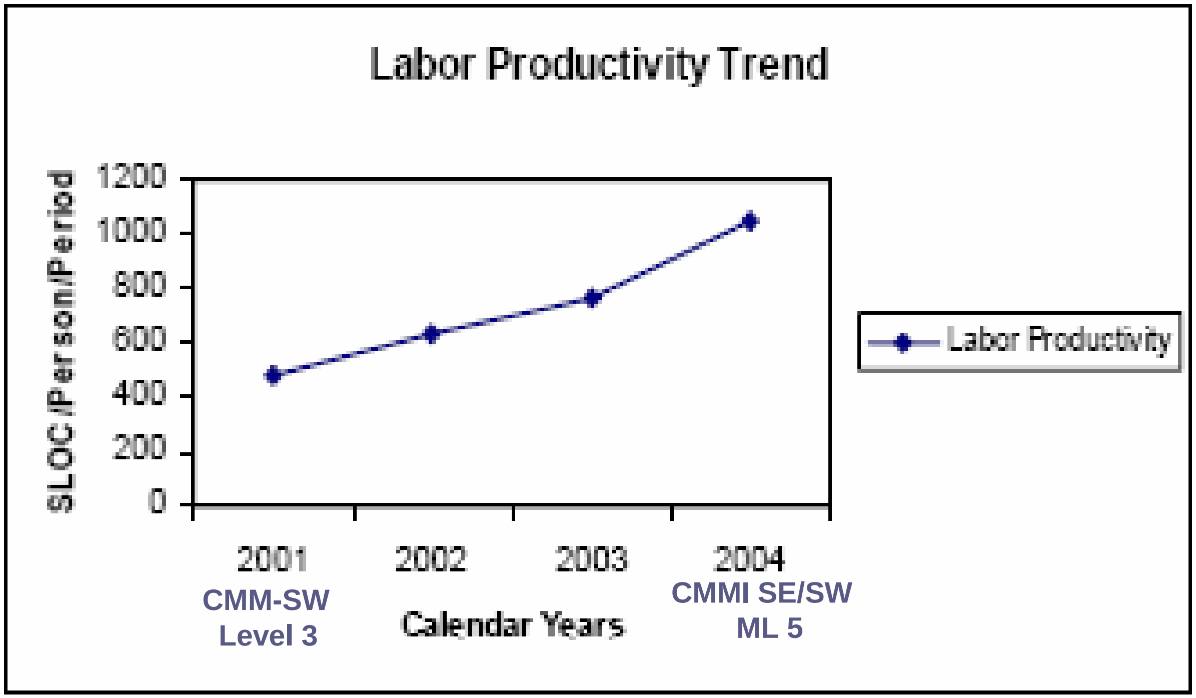
- Deliveries on time
  66% in 2001
  79% in 2002
  89% in 2003
- In 2004 we expect to fulfill our objective that we deliver at least 90% on time

SYSTEMATIC
software engineering

2002 CMM Level 3
2004 CMMI Maturity Level 4

Performance Measure: Productivity

And More Trends …



Labor productivity averages have increased, influenced by variables such as programming languages, technical improvements, etc.

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CMMI ®

Performance Measures: Cost, Schedule & Productivity

Comparison of B1 and B2/3/4 Metrics

Raytheon
NETWORK CENTRIC SYSTEMS

- **Productivity**

  B1 SIL I&T Productivity = 2.1 LOC/Hr

  B2/3/4 SIL I&T Productivity = 3.4 LOC/Hr

  — 62% improvement

  Other Factors: Team had gained experience in all aspects of development

- **CPI and SPI**

  JUL 2001 Cum CPI / SPI = .91 / .93

  JAN 2002 Cum CPI / SPI = .96 / .99

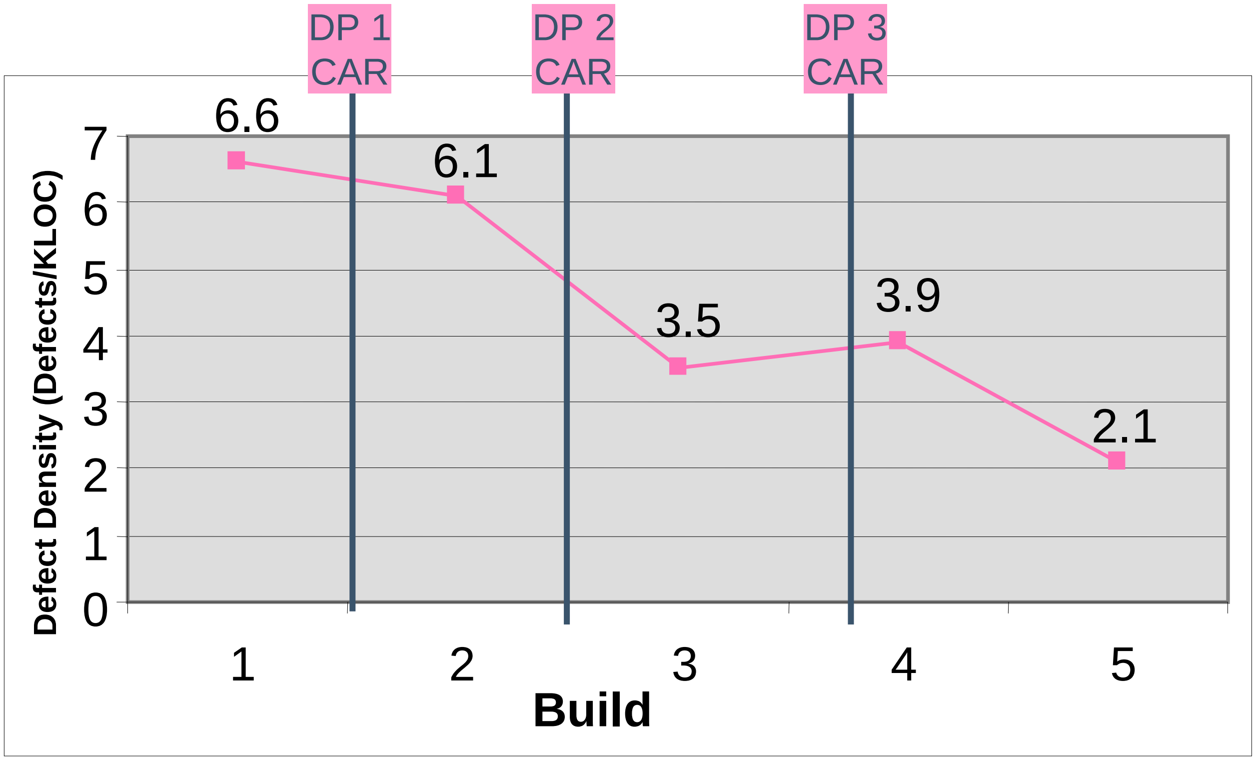
  — 5% / 6% improvement

  Other Factors: By July 2001, 81% of budget was spent making it difficult to improve the cumulative CPI and SPI

20

Performance Measure: Quality

Defect prevention using PSP and CAR at CMMI ML5



Integrating PSP^{sm} and CMMI® Level 5. Gabriel Hoffman, Northrop Grumman IT . May 1, 2003.

Northrop Grumman IT

Hours invested: 124

- Team training: 48
- Conducting DP/CAR Cycles: 76

Defects avoided: 110

- If defect density had remained at Build 1 baseline

Hours saved: 1650 hours

- At an estimated cost of 15 hours per defect

Return:

- Hours: 1650/124
- ROI: ~13:1

Performance Measure: ROI

TATA **Delivery processes** 1 of 8

Individual / Project Level: PIPs

- Defect prevention and tools; e.g.,
  - Beyond Compare: to synchronize code configuration between sites
    ROI 24.26 and savings of $58K
  - Insure++: reduced rework effort through early detection of memory leaks
    ROI 4.28 and savings of $95K
  - Use case Estimation Guideline and template
    ROI 5.33 and savings of $1.6K
  - Conversion tools
    ROI 8.2 and savings of $314K
  - NCR average open days through a Six Sigma project
    Reduced from 31 to 12 days

TATA

10

TATA CONSULTANCY SERVICES
TCS. Beyond the obvious™

Remember

Don't over interpret these results out of context

- The cases differ in:
  - Organization & model scope of their process changes
  - The time span of the process or other technology interventions they report
  - The specific measures they use
  - Measures of organizational context
- Some of the results also may be atypical & exemplary

However

- They do constitute ample proof of concept of the potential of model-based process improvement

Today's Talk

Measuring Performance: Why Care? What Counts?

Summary of existing results

More detailed results: Maturity Levels 2 & 3

More detailed results: High Maturity

Current Directions

Enhancing Quality & Quantity of the Evidence

More & better case studies are not enough

- Broadly based samples needed to attribute results to CMMI based processes *versus* other factors / unintended measurement effects

Need for a viable benchmarking infrastructure & community of practice

- In a field where people aren't comfortable sharing information

What's Needed?

Evidence from case studies can be accused of "cherry picking" -- Fairly or not

Must be proactive: credible <u>comparative</u> evidence is sorely needed

- To better demonstrate the statistical relationships between process capability & program performance
- Controlling for other characteristics that may affect both

By now are many Maturity Level 4 & 5 organizations

- Over 110, mostly ML5 at this time last year

Many CMMI Maturity Level 2 organizations should have at least selected amounts of pertinent measured results as part of their PP & PMC activities

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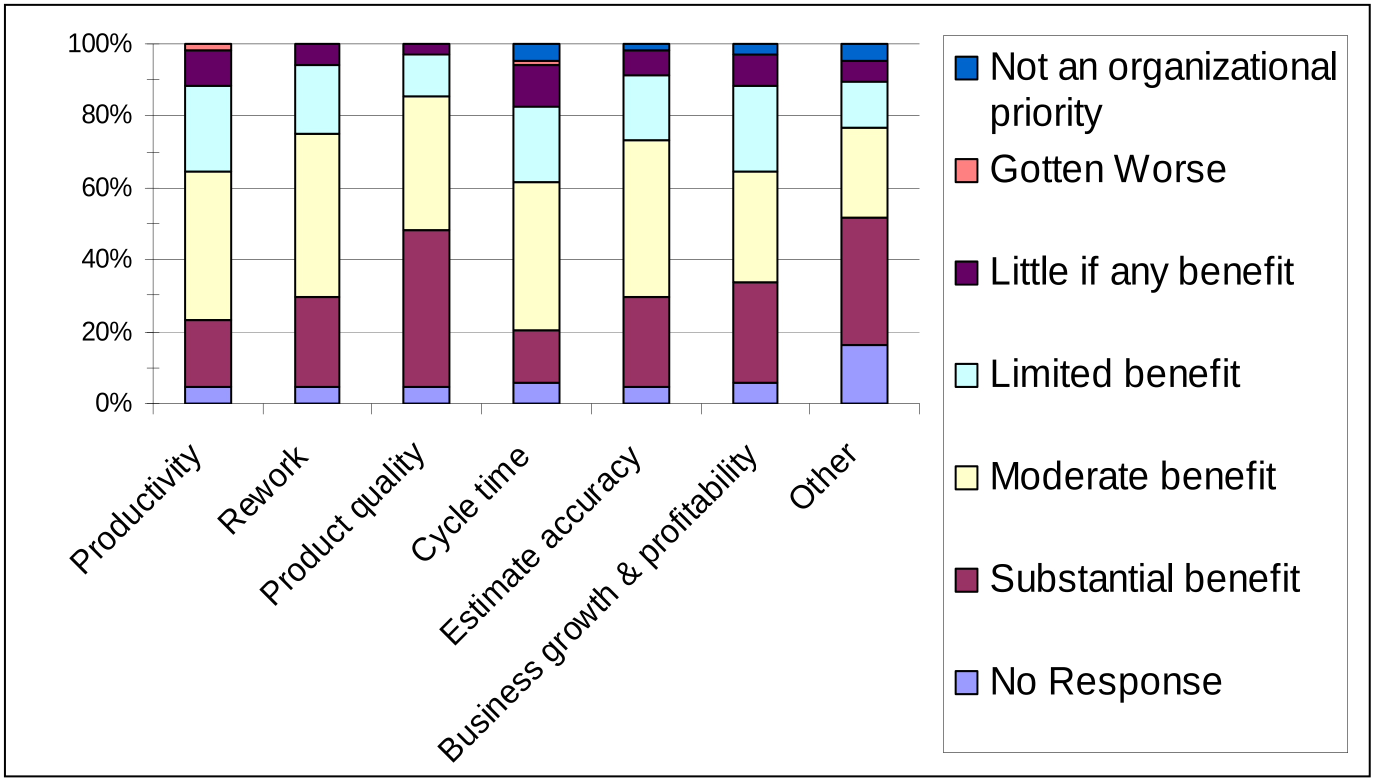
Some Results of Adopting CMMI



N = 68; Mostly high maturity organizations

Source: *Benchmarking CMMI Cost and Impact: Interim Report*, December 2004 (Distribution of full document limited to benchmark contributors.)

Results From…

Simple benchmarking exercise presented at 4th CMMI Technology Conference in Denver last November

- Focus on:
  - Costs & investment in process improvement
  - CMMI adoption
  - Implementation & appraisal strategies
- A little on benefits of CMMI-based process improvement

Mostly high maturity organizations

- Still, quite promising
- 73% have quantitatively measured improvement results
- 68% have done ROI or related cost benefit analyses
- Accompanied by compelling qualitative descriptions!

What's Next?

CMMI performance results web site

- Updates & enhancements

A new summary TR

- Addition of brief case reviews ("vignettes")
    - To provide context for the quantitative results

Articles on CMMI performance results

- For *Software Process Improvement and Practice*

Any information you can share with us will be welcomed and appreciated

What Else?

Enterprise performance measurement and benchmarking

- Focus on causal analysis of variation in program success and failure
- Working with organizations that already have or are willing to develop common measures

Exploring several options for emphasis in FY06-07, e.g.:

- A web based benchmarking service
  - Perhaps seeded by a proactive survey
- Focused custom surveys

Any ideas or information you can share with us will be welcomed and appreciated

To Summarize…

There is ample evidence about the results of model-based process improvement

Still, we need more & better evidence

- Serious attention to benchmarking
  - Better understanding the state of the practice
  - Understanding what accounts for relative failure as well as success
- Richer case studies
- Practical guidance
  - Validating estimates and improving ROI & process models
  - Measurement, validation, data quality & analytic methods

Our bottom line: Actionable guidance using measurement to inform better decisions

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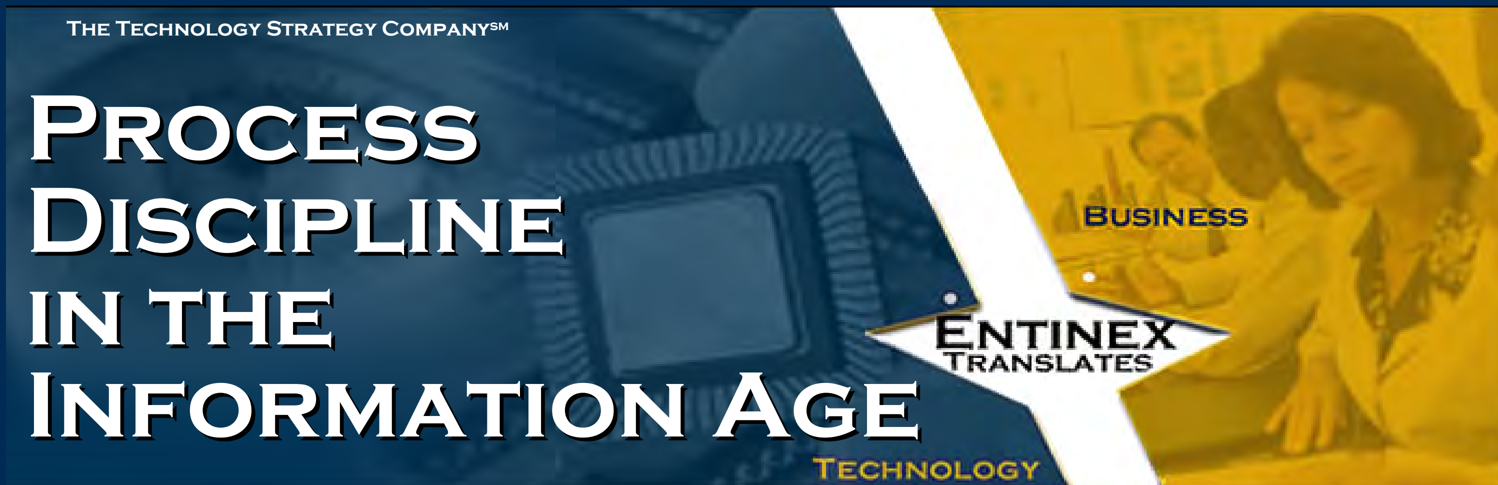

Rethink the "Quality" Abstraction

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Purpose of Presentation

- To shed light on…
  - Today's software market & how it's different from the software market when QA (process discipline) was first applied.
  - Why traditional QA fails in today's software development environment.
  - How QA needs to be structured to work in today's software development environment.
  - What "agile" software development is and isn't.
  - How agile software development can be disciplined.

Agenda

- Introduction
- Understanding Agile
- Role and Goal of "QA"
- Historical Role of QA
- QA in Business
- A Word About Development Processes
- QA in the Context of Development Processes
- Rethinking the Quality Abstraction
- An Implementation Example with Scrum
- Conclusion

Who Is This Guy?

- Personal Introduction
- Fresh Fish in the Fire
- Jedi training
- The Dark Side
- Why Talk?
- Staying/Straying on Topic
- "…Slings and Arrows…"
- Tom Peters!

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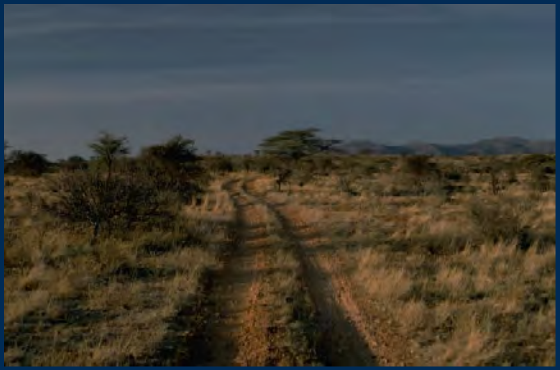
Introduction

- ▲ Why "Re-Think" the Quality Abstraction?
- ▲ QA's Legacy Mindset
- ▲ Software Today and Yesterday
- ▲ Movement in the Software Industry
- ▲ Why/Where Lightweight and Heavyweight Collide
- ▲ Disciplined vs. Undisciplined
- ▲ QA as a Valuable Asset



Why "Re-Think" The Quality Abstraction?

- Align process and product technologies
- Align development environment
- Align with market forces

QA's Legacy Mindset

- Large Products
- Software a component of the product
- Technology trade-off
- Software is now the entire product

Software Today and Yesterday

- Compare today's software products to those 10, 15, 20+ years ago
- How are they similar?
- They are more different than they are similar.
- QA hasn't changed with the technologies and methodologies

Movement in the Software Industry

The Technology Strategy Company℠

- Companies attempting process QA initiatives found everywhere on the side of the road
- Agile/Lightweight seen as a “way out”
- Cannot ignore the trend
- “Lightweight” in response to “Heavyweight”

Why/Where Light & Heavy Collide

- Attitude
- Strengths
- Weaknesses
- Typical approach to QA propagates legacy methods & mindset
- There's no such thing as robust QA in lightweight development ?!

Disciplined vs. Undisciplined

The Technology Strategy Company[SM]

- Lightweight is thought of as undisciplined?
- Could it be QA's fault?
- Can lightweight/agile development also be robust?
- Can QA become appropriately agile?
- Can a mindset "re-set" about QA be applied?
- Could an abstraction be created for QA that works in any environment?
- Could it be used to improve QA in non-lightweight software environments?

QA as a Valuable Asset

- QA activities are expected to be:
  - value-added
  - a component of a comprehensive product development process.
- Look at QA in terms of:
  - its basic goals.
  - how to adapt what QA professionals do to meet those goals.
- Developed a QA approach that:
  - works in any environment
  - Is still in complete compliance with standards, and policies.
- A change in abstraction will cause:
  - how QA "shows up" on a project,
  - ***not*** what QA is expected to accomplish.

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Understanding "Lightweight"/ "Agile"

- Lightweight Reputation
- True Purpose of Lightweight/Agile Development
- Development in the Absence of Process?
- Working Definition of Lightweight/Agile Development
- Agile Alliance

Lightweight Reputation

- Lightweight development varies widely from organization to organization.
- Lightweight/Agile the reputation as undisciplined.
- Narrow implementations of the concepts, rarely following any formal development guidelines.
  - ∴ the reputation is unfair.
- Coding without rules, process discipline, or management tools is undisciplined.
  - This is not what agile development is.
  - Any more than the original intent of effective QA was to be heavy-handed.

True Purpose of Agile Development

- The purpose of lightweight development is to allow for better productivity.
- The enemy of productivity is heavy-handed process controls.
- True, some developers pursue lightweight development thinking they can shed controls, checks, and balances necessary to make good products.
- This is far from what lightweight is about.

Development in the Absence of Process?

- If this were true, then lightweight developers would be operating under a modus operandi that reads:
  - "produce quality software in the absence of any process".
    - This would be absurd.
    - Lightweight supporters do not agree with this.
- It's not the absence of process that makes a development method lightweight.
- It's the absence of unnecessary or obstructive processes that makes a method lightweight.

Working Definition of Agile Development

- The minimum, most unobtrusive approach to developing software that produces a quality product when the customer expects to get it, at the price they expect to pay.

Agile Alliance

- Principles:
  - **Satisfy the Customer** thru valuable software
  - **Changes happen**, harness them for the customer's benefit
  - Deliver **working product frequently**
  - The **business must work with the developers**
  - Hire **motivated people, support them, let them work**
  - **Face-to-face beats paper**
  - **Working software is the best** measure of progress
  - If it's **not sustainable, it's not agile**
  - Agility depends on **continuous attention to technical excellence & good design**
  - **Simplicity is key** to maximizing work not done
  - **Self-organizing teams** produce the best technical results
  - *Regularly reflect on becoming more effective and tune & adjust.*

Agile Alliance, 2

- Manifesto:

"We value:

Individuals and interactions ***over*** *processes and tools*

Working software ***over*** *comprehensive documentation*

Customer collaboration ***over*** *contract negotiation*

Responding to change ***over*** *following a plan*

That is, while there is value in the items on the right, we value the items on the left more."

- Is this anti-process?
- Can anyone prefer the process to actually delivering the product?

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Role and Goal of "Quality Assurance"

- Proactive or Reactive?
- How to Entice Developers to Follow a Process
- Working Definition of QA
- Working Policy Statement of QA

PROACTIVE OR REACTIVE?

- Realistically, in the typical QA approach not all activities performed to "satisfy QA requirements"
  - productive,
  - pro-active,
  - value-added contributions to producing the product.

- Otherwise, developers would use typical QA processes.

How to Entice Developers to Follow a Process

- Time away from development isn't productive
  - (documentation of work already performed)
- Reconciling heavyweight and lightweight practices will be found by bridging this gap.
- Create processes that parallel development.

Working Definition of QA (Process Discipline)

- A process/effort that ensures that processes are followed, that
- the processes have us doing
  - the right things,
  - the right way, and
- when they fail to be used or fail to perform as expected we have a way to
  - correct,
  - adjust, or
  - escalate the matter until it is resolved to everyone's satisfaction.

Working Policy Statement of QA

- *All processes must forge a working relationship which*
  - *actively supports development's productive activities*
  - *avoids creating additional effort for development functions outside of the project's stated development function processes*
  - *designs processes in collaboration with the project's development community*
  - *allows the process owners to achieve their process and product oriented objectives*
  - *reaches consensus on a balance between process and productivity.*
- *The goal:*
  - *fully integrate the necessary process steps into activities that add value to the development effort while*
  - *resulting in insight, predictability, measurements and traceability of process effectiveness.*

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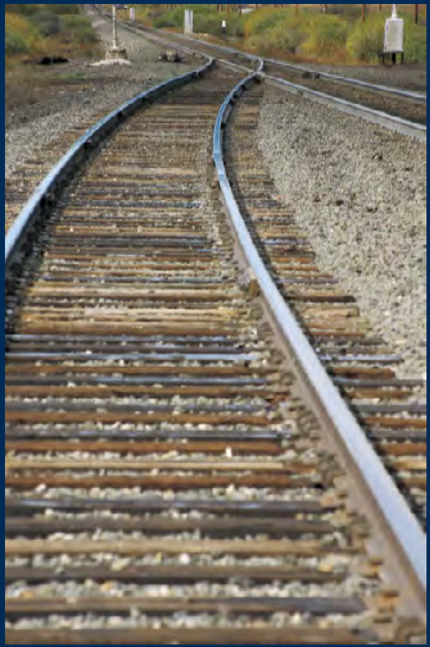
Historical Role of QA (Process Discipline)

THE TECHNOLOGY STRATEGY COMPANY℠

- QA Has Come a Long Way
- QA Has Far to Go
- QA's Value to Business
- What Fuels Processes?
- Original QA Processes
- Applied to Software?
- One Transformation Matrix After Another



Translating technology dollars into business sense.℠

QA (Process Discipline) Has Come a Long Way

- QA undergoes continuous improvement in terms of its application as well as acceptance.

- QA is an official component of many project plans and a valued resource in many projects and organizations.

- QA can hold up a project with process problems, and "dress down" a project manager for skipping steps.

QA (Process Discipline) Has Far to Go

- Unfortunately, QA is still sidelined too often when business needs take priority.
- Too often, QA still has the reputation of "policing" rather than a contributing to the effort.
- Frequently, business owners will bypass managers and go directly to developers when such layers are seen as getting in the way.

QA's Value to Business

- Showing the business value of QA through analyses, 6-sigma SPC, and other techniques are still more ***re***active than ***pro***-active.

- What developers (and executives) want are processes that implement QA so that they don't
  - slow progress,
  - break momentum, or
  - install the sense that people are being policed.

- Such processes are demoralizing.

What Fuels Processes?

- Processes are fueled by people
- People hate heavy-handed processes.
- Developers seek “lightweight” methods in hopes of finding refuge from heavy-handed processes.
- Many throw out the mantle of all processes.
- The origins of QA standards explains much…….

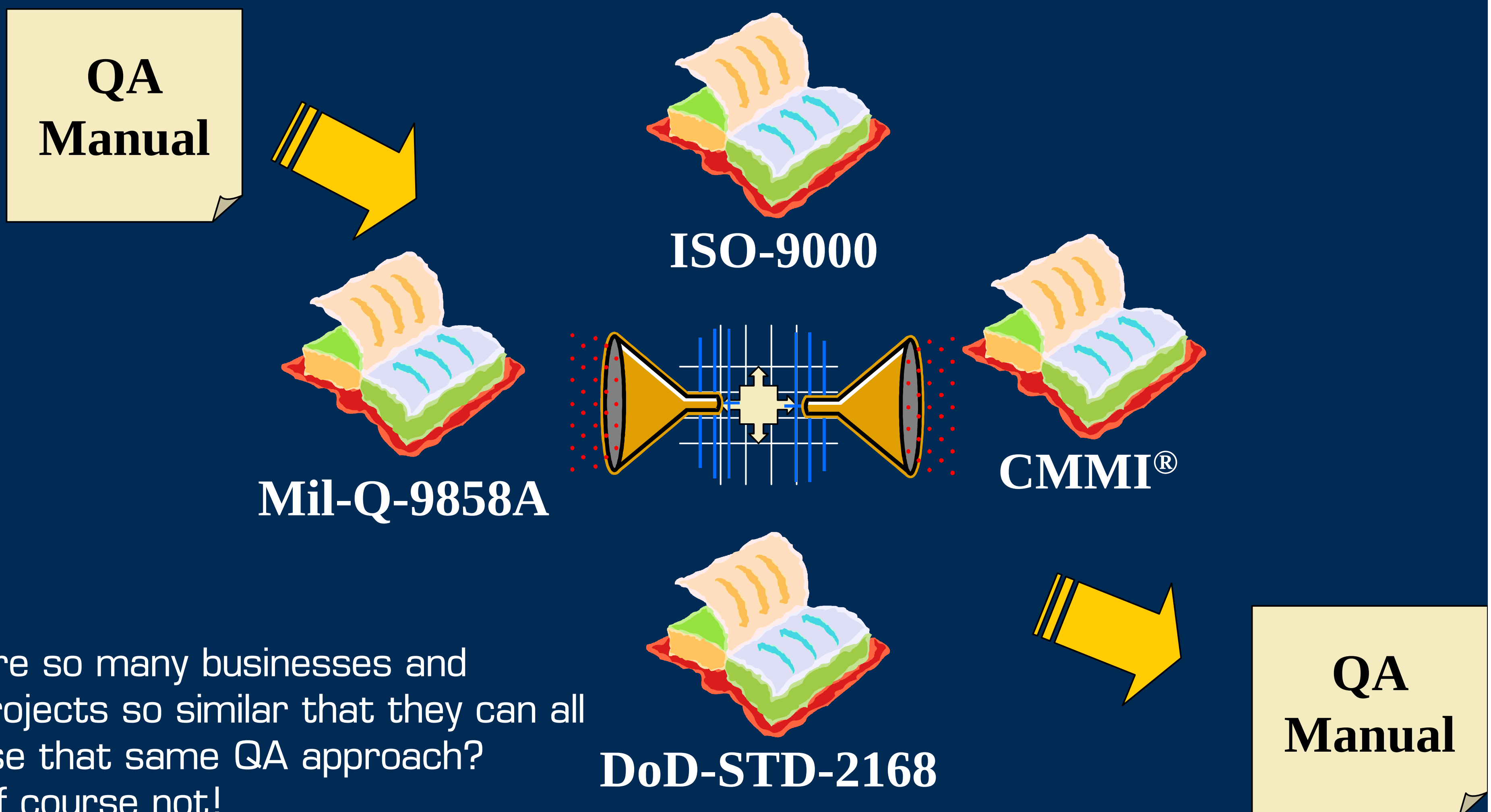
Original QA Processes

- Early software projects were
  - big,
  - slow, and
  - geographically dispersed
- Early projects were characterized by
  - layers of bureaucracy
  - designed around project management methods that also built tanks, planes, and ships.
- Based on manufacturing work-flow and controls.

Applied to Software?

- These QA methods fail to achieve their intended goals.
- *Software development paradigm shares very little with the manufacturing paradigm.*
- Methods of performing QA have not made the shift across the industry.
- Defense and similar large-scale old-style projects shaped much of what is known today about QA.
- Compared to today's technologies and the speed to market, these legacy projects provide a very limiting pool of experience.

One Transformation Matrix After Another



Are so many businesses and projects so similar that they can all use that same QA approach? Of course not!

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QA in Business

- Absorption of QA in Larger Projects
- Needs of Development: QA at the Pace of the Project
- Needs of Company: *Working Product*
- QA the "Easy" Way vs. the Way QA Works Best

Absorption of QA in Larger Projects

- The non-productive activities and paperwork created by legacy QA abstractions is most felt at the development level.
- In many large, complex projects, the additional effort and time needed to follow the processes are easily absorbed by the project.
- The pace of these projects are such that the deliberate (if not judicious) addition of time and work can be handled.

Development's Needs: QA at Project's Pace

- Development needs to:
  - stay productive,
  - control costs, and
  - keep people motivated.
- The effort to follow the process should not overshadow the pace of the project.
- Agile development recognizes the need for processes that allow a project to get done at the pace of the project.
- Many processes, QA included, have fallen short because they do not account for the pace and complexity of the project.

Needs of Company: Working Product

- Modern software needs QA processes:
  - more closely fitted to each project,
  - dynamically adapting to the project and making development cheaper, better, and faster on every subsequent project.
- Truly add business value to the QA process.
- On time working product is a must.
- Processes must reflect the demands of the customer. First and foremost.
- Processes must be adaptive and scalable to handle exceptions.

QA the "Easy" Way vs. the Way QA Works Best

- Historically, legacy QA processes not designed with attention to business goals.
- Latest models promote processes that add value.
- Few implementations ever achieve that.
- Instead, companies supplement existing processes with a disruptive, paper-intensive meta-layer.
- Produce evidence that a process is being followed.
- Do not contribute to productivity.
- This has not changed in decades.

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A Word About Development Processes

- Relationship Between Management Methods and Development Methods
- De-Coupled Methods
- Software Methods

Relationship Between Management and Development Methods

- Hardware can be designed and manufactured in any one of several ways:
  - Design can be on paper, or using Computer Aided Design (CAD) systems.
  - Manufacturing can be by skilled artisans or can employ automated systems.
- These are the "development methodologies".
- Tools and tool control, inspection, inventory control, materials ordering, environmental controls, organizational needs.
- These are "management methodologies".

De-Coupled Methods

- The development and management methodologies, therefore, are distinct.
- Not completely de-coupled, however one does not dictate the other.
- They must:
  - complement and support one another.
  - work together to achieve business goals.
- Desirable to be optimized to work in the same business and operations strategy models.
- Fundamentally, whether blueprints are drawn by hand or by CAD is not dictated by how the flow of material is controlled through the plant.

Software Methods

- In the software world, for example, CMMI® doesn't care what development methodology is used.
- CMMI® doesn't dictate use of the "Waterfall" or Spiral models, or imply that XP is better than Scrum, "Crystal Light", and so on.
- Distinguishing the software *development* methodology from the software *management* methodology <u>eliminates</u> one of the barriers to managing QA in lightweight development environments.

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QA in the Context of Development Processes

- ▲ Role of QA in the Development Process
- ▲ Responsibility of QA in the Development Process
- ▲ QA in Support of Development
- ▲ QA Distilled
- ▲ Processes within Lightweight Environments

Role of QA in the Development Process

- QA's role in the development process is fairly simple.
- Standards, methods and processes need to be followed and need to work well for the project.

Responsibility of QA in the Development Process

- QA is responsible for ensuring:
  - project's methodologies are taught to new developers on the project;
  - methods are followed by everyone, and
  - QA activities for projects are planned and not spontaneous.
- QA must:
  - measure the effectiveness of the methods,
  - provide visibility to management via appropriate metrics from prior project QA experience, and
  - know when the methods need to be adjusted.
- A person independent of the political and organizational chain-of-command are recommended to avoid conflicts-of-interest to achieve appropriate objectiveness from the product and its stakeholders.

QA in Support of Development

- QA must support the project in achieving the intended benefits of the standards the project sets for itself.

- If the project's processes and activities do not promote or support its standards, policies, or methods, it's QA's job to bring this disconnect to the attention of the people who can make appropriate changes.

QA Distilled

- QA boils down to making sure that the things that need to take place can happen and are happening, and that when they don't they get fixed.
- Everything else is technique.
- "Keeping things simple" is critical to a well-formed abstraction.
- When QA is distilled to the above statements, possibilities are created regarding how to look at the organization's QA processes so that they can operate in any environment.

Processes within Lightweight Environments

- Lightweight development doesn't mean there are no:
  - requirements management,
  - QC,
  - QA,
  - CM,
  - project planning,
  - project tracking, or
  - reviewing of designs and work.
- Development without those things would be called ***stupid*** programming, not ***agile*** programming.

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Rethinking the Quality Abstraction

- ▲ Challenges of Current (typical) QA Approaches
- ▲ Necessary Value and Effectiveness of QA
- ▲ Real or Perceived "Pro-Active" Effort
- ▲ QA Processes Needed by the Market and Development
- ▲ Technology for Real-Time Analysis
- ▲ Transforming the Abstraction
- ▲ Desired "Target" Abstraction
- ▲ Section Summary

Challenges of Current (typical) QA Approaches

- Many QA processes rely on generating
  - artifacts,
  - evidence, and
  - other labor-intensive "bread crumbs"
  - tangential to the work being done on the product itself.
- These tangential efforts rely on the same people as development and therefore cannot occur on top of production, therefore increasing the amount of time it takes to carry out a project.
- **Stove-Piped** ☜ ☜ ☜

Necessary Value and Effectiveness of QA

- This approach to the QA process:
  - relegates QA to the role of policing and gate-keeping,
  - drastically minimizes the positive impact of the overall effectiveness of the QA program.
- One can seriously (and not without merit) question:
  - timeliness,
  - contribution, and
  - overall value
  - of QA
- … when the activities defined by or for QA purposes do not benefit the project.

Real or Perceived "Pro-Active" Effort

- "Proactive" QA is still seldom *pro*-active throughout the lifecycle of development.

- Proactive often means a level of effort before a project starts, followed by periodic or event-driven reactive activities that are only conducted as events unfold.

- It's this entire approach that needs "re-thinking".

QA Processes Needed by the Market and Development

- **NEED**: Process that:
  - ensure processes are matched to project objectives before the project gets under way
  - get into the detail of the standards and methods so that when the standards are followed they automatically generate the necessary “proof” of process compliance.
- **DON’T NEED**: Processes that
  - simply create automated markers and flags, or
  - reinvent the “wheel”
- **INSTEAD**:
  - approaches that enmesh metrics and data generation into the development process so that the successful output of the process is only possible if the process was properly followed.

Technology for Real-Time Analysis

- Use the technology of the development process, tools, and standards as the medium to collect process and tracking data

- Instead of policing the processes through post-mortem artifacts, QA could be free to analyze the effectiveness of processes in real time and make adjustments.

Transforming the Abstraction

- The actual abstraction transformation is simple.
- Instead of focusing the quality process on the effort of proving a formal process is followed, ensure that the processes are:
  - effective,
  - productive, and
  - valuable to the goals of the business, and
- Create production methods that produce the evidence as a by-product of the effort rather than a separate activity.

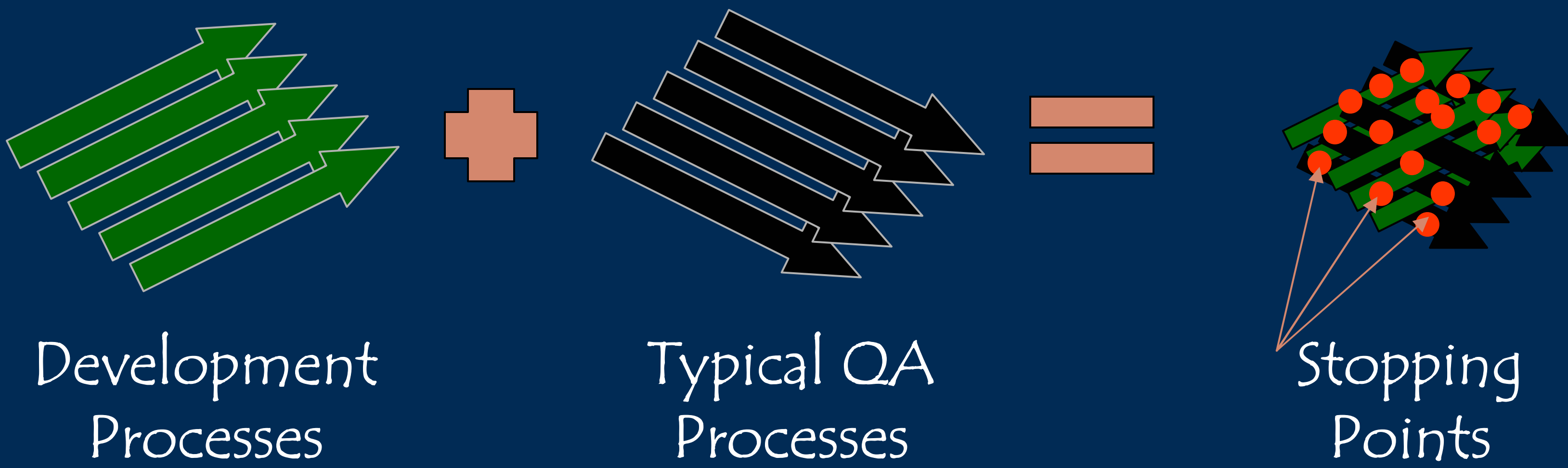
Desired "Target" Abstraction

- Transforming FROM:
  - A reactive, investigative, and stove-piped approach
- TO:
  - a productive, business-driven, value-focused umbrella of activities that improve the development effort
- Will achieve the "rethinking" of the QA abstraction that is necessary for lightweight development methods.

Section Summary

Go from this:

- Ordinary implementation of QA in development environments.

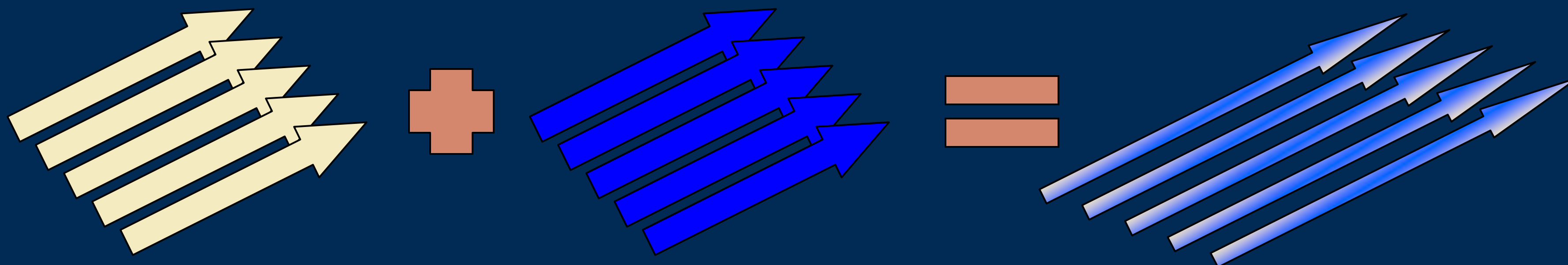


- QA processes are in super-imposed onto development processes.
- Add a layer of effort not in-line with productivity.

SECTION SUMMARY

TO THIS:

- Preferred implementation of QA in development environments.



Development Processes + Agile QA Processes = Ø Stopping Points

- QA processes are integrated into and aligned with development, increasing development productivity.
- Contributes to capacity and value of company.

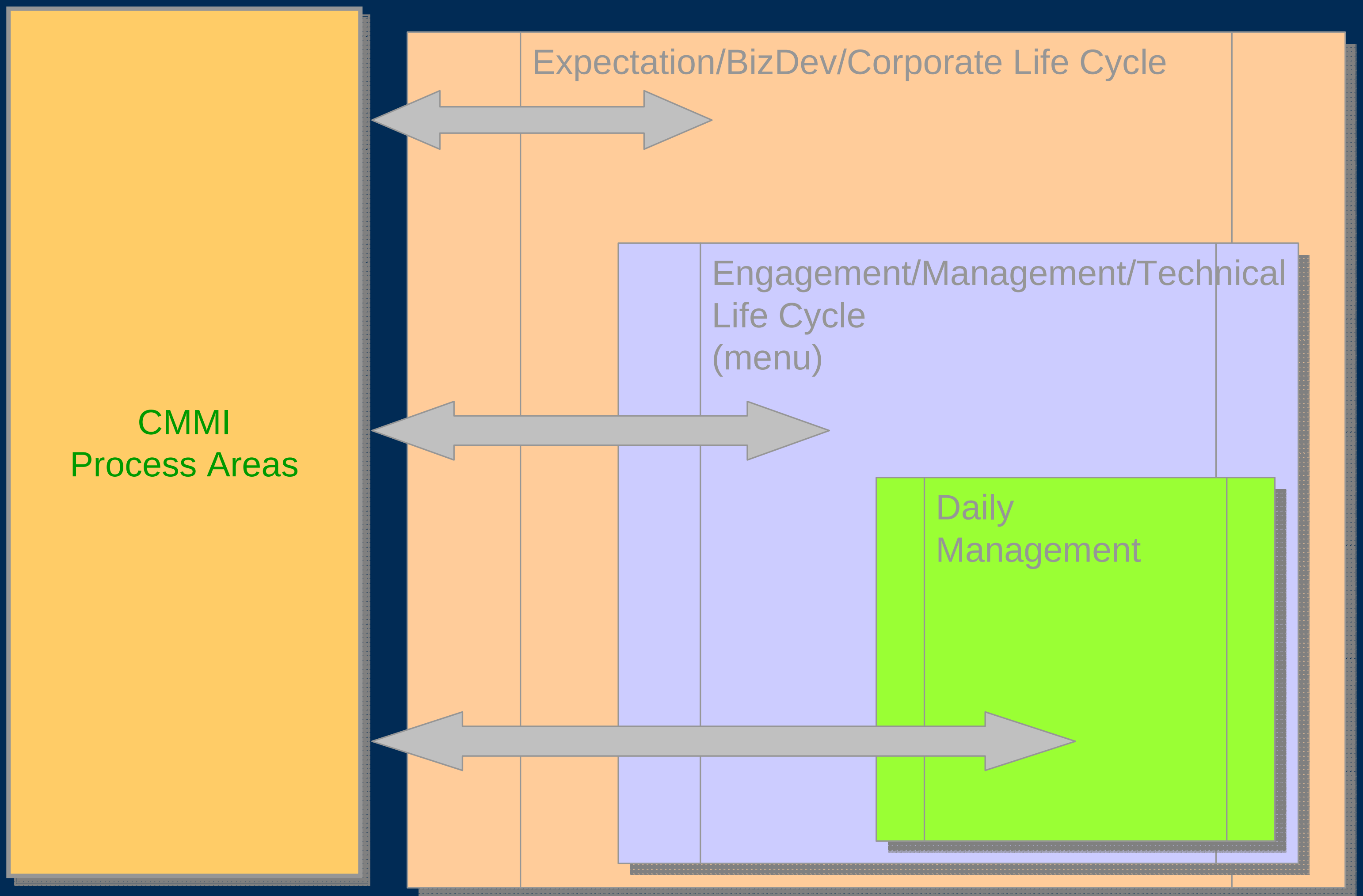
Agenda

- Introduction
- Understanding Agile
- Role and Goal of "QA"
- Historical Role of QA
- QA in Business
- A Word About Development Processes
- QA in the Context of Development Processes
- Rethinking the Quality Abstraction
- An Implementation Example with Scrum
- Conclusion

An Implementation Example

- Collect the desired practices that add the desired discipline.
- Find the actual work being done at a given location.
- Insert the practices into where the work is done.
- ID/Define life cycles in which actual work happens.
- Centralize redundant policies, processes, procedures and templates.

If *A* picture is worth…



Translating technology dollars into business sense.[SM]

…How much are *Several*?

Policy

Establishes that company projects will adhere to formal processes and states company's policy for quality values, quality work, and how these align with the company's mission and vision.

Quality Manual

Outlines what company does to ensure on-time, on-budget, fully featured/functional projects.

Expectation/ Corp /BizDev Fulfillment Life Cycle

Outlines the phases of every project @ company and scopes activities and deliverables within each phase. Establishes each project's parameters.

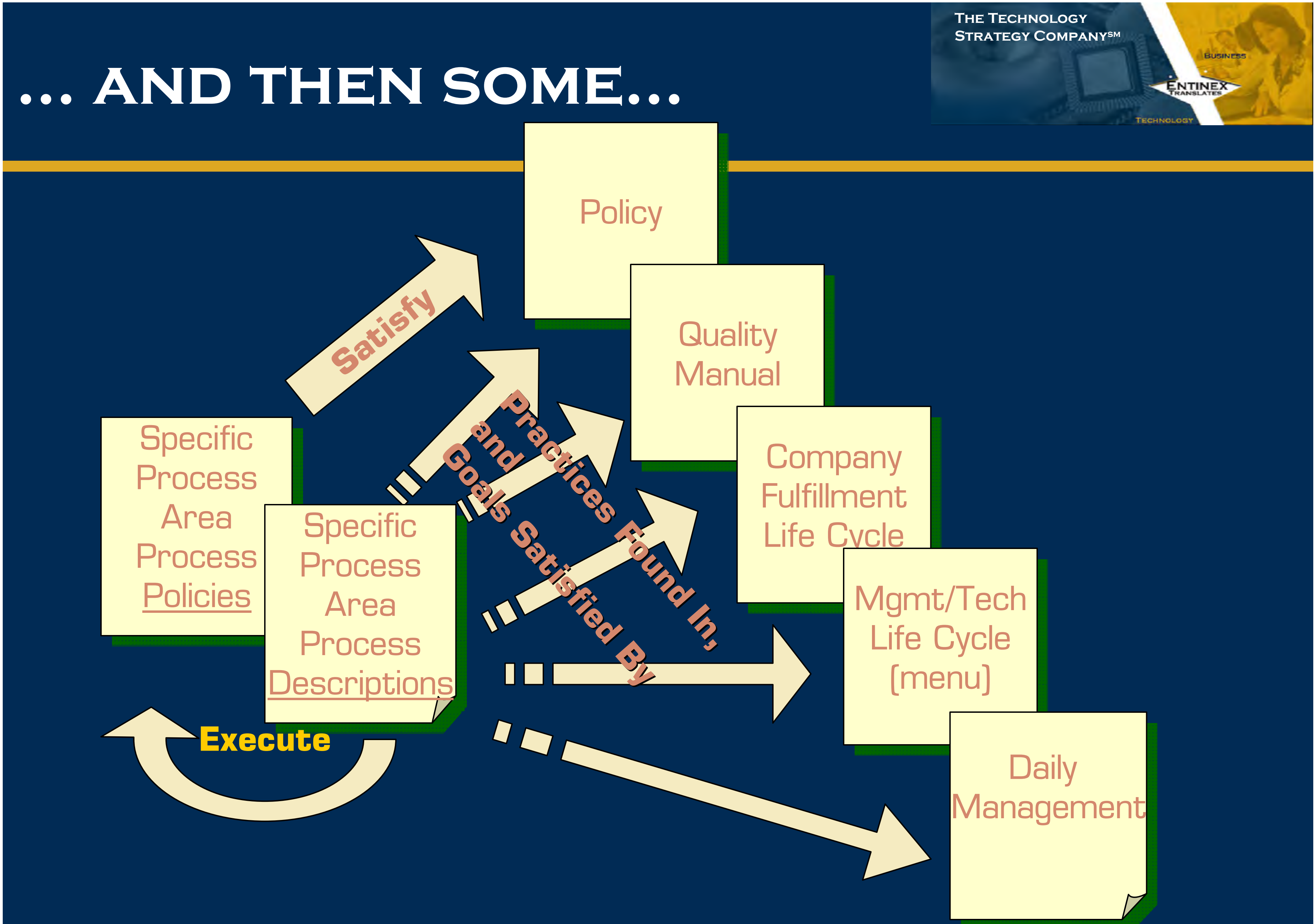
Engagement/ Mgmt/Tech Life Cycle (menu)

A menu of management or technical activities that each project can choose from as appropriate. Each project is required to identify a life cycle. This menu provides the list of what can be in a life cycle.

Daily/Weekly Management

Specifies how projects are managed.

... AND THEN SOME...



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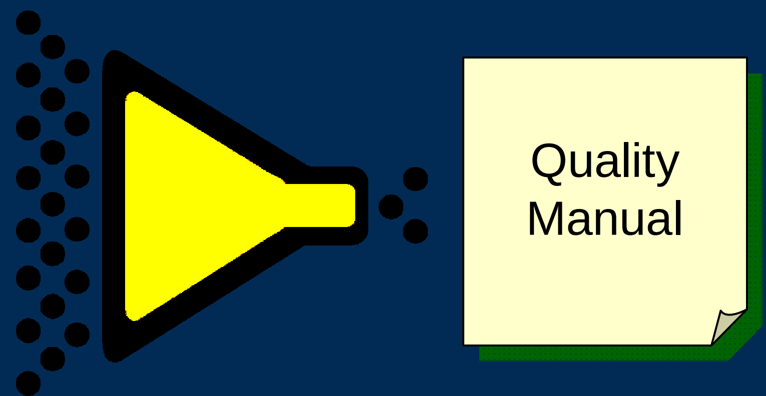
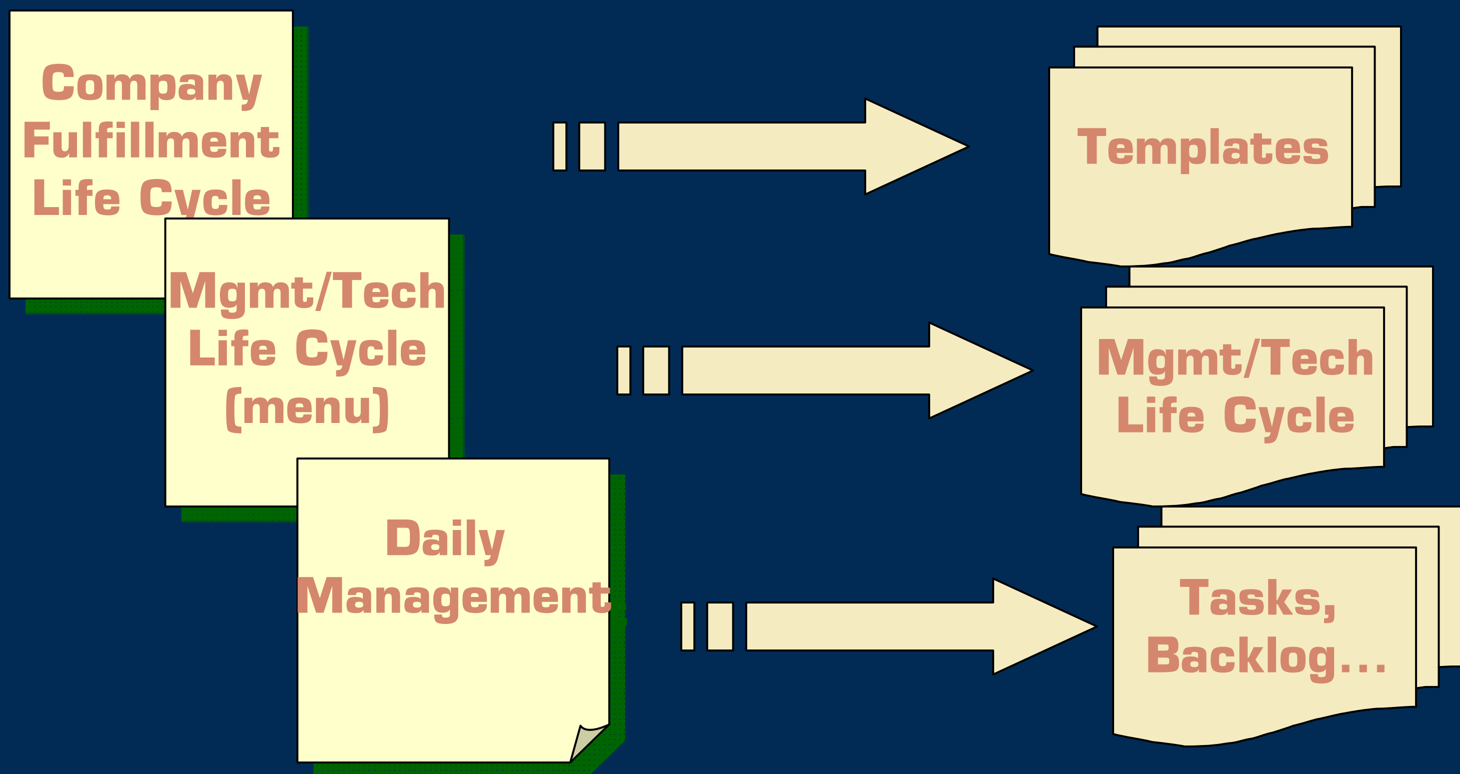
What's in the Quality Manual?

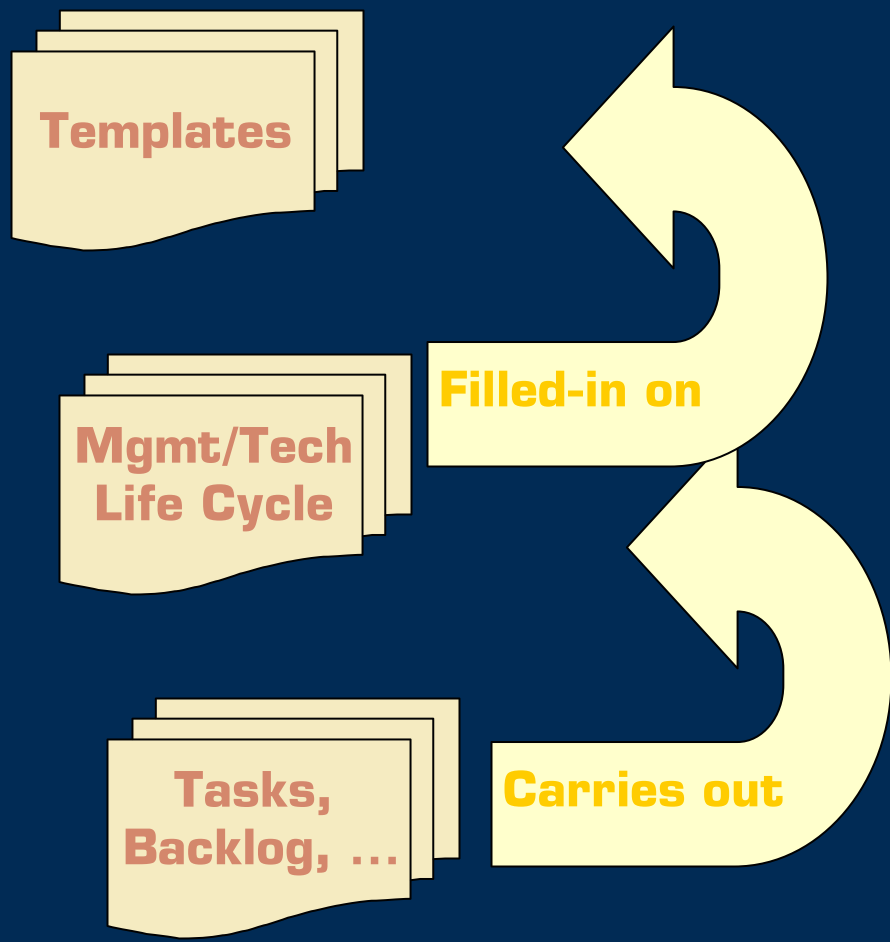
- **Explains how on each project, all company Processes:**
  - are planned-out and tailored from a single set of company processes
  - are assigned as someone's responsibility
  - are provided resources to be done
  - are assured of having people trained in them
  - have their work products configuration controlled
  - involve relevant stakeholders
  - are monitored & controlled
  - are objectively evaluated against applicable standards,
  - have performance reviewed with higher management, and
  - incorporate lessons learned for improvement



WORK-PRODUCT GENERATION



Work-Product Interactions



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Company's Project Life Cycle

Fulfillment Life Cycle

- Phase 1: Initial Analysis & Response
- Phase 2: Planning/Kick-Off
- Phase 3: Follow-Through
- Phase 4: Close-Out

Phase 1 Concepts

Phase 1: Initial Analysis & Response

Phase 2: Planning/Kick-Off

Phase 3: Follow-Through

Phase 4: Close-Out

- Get from RFP to Award and/or from Award to Start
- Provides a business basis for going forward
- Provides requirements against which to manage the initial activities
- Scopes the project before details are known
- Breaks out of the Catch-22 of "when does the project start?"
- Allows for minimal mock-ups or prototyping/engineering analysis to obtain project requirements agreement.

Phase 2 Concepts

The Technology Strategy Company℠

Phase 1: Initial Analysis & Response

Phase 2: Planning/Kick-Off

Phase 3: Follow-Through

Phase 4: Close-Out

- Identifies the project's:
  - Type
  - Management or Technical Life Cycle
  - Major Product and Document Deliverables
  - Major Tasks
  - Assignments, Roles and Stakeholders
  - Resources, Tools and Assets
  - Plans
  - Project Monitoring Events
  - Milestones
  - Required Training
  - Measures & Analyses

Phase 3 Concepts

Phase 1: Initial Analysis & Response
Phase 2: Planning/Kick-Off
Phase 3: Follow-Through
Phase 4: Close-Out

- All detailed engineering and provisioning of the solutions and products
- Execution of the entire Management or Technical Life Cycle
- From Design through Delivery and Installation
- Can be iterative with Phase 2
- All phases of the daily process through Closure

Phase 4 Concepts

Phase 1: Initial Analysis & Response

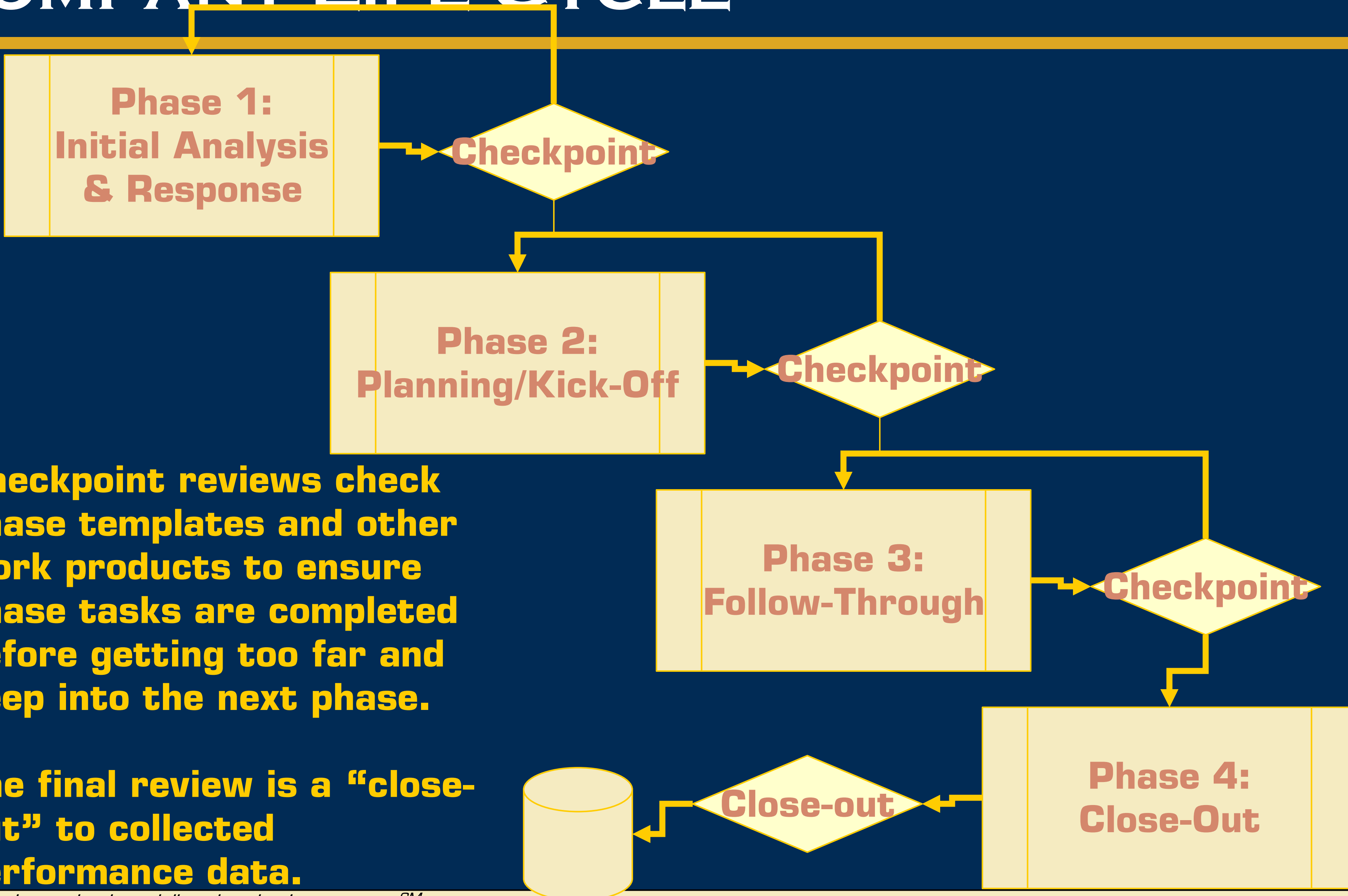
Phase 2: Planning/Kick-Off

Phase 3: Follow-Through

Phase 4: Close-Out

- Opportunity for Lessons Learned
- Final Administrative Checks
- Customer Feedback
- Final PPQA Checks & Audits
- Final CM Audits

PPQA Concepts in Company Life Cycle



Checkpoint reviews check phase templates and other work products to ensure phase tasks are completed before getting too far and deep into the next phase.

The final review is a "close-out" to collected performance data.

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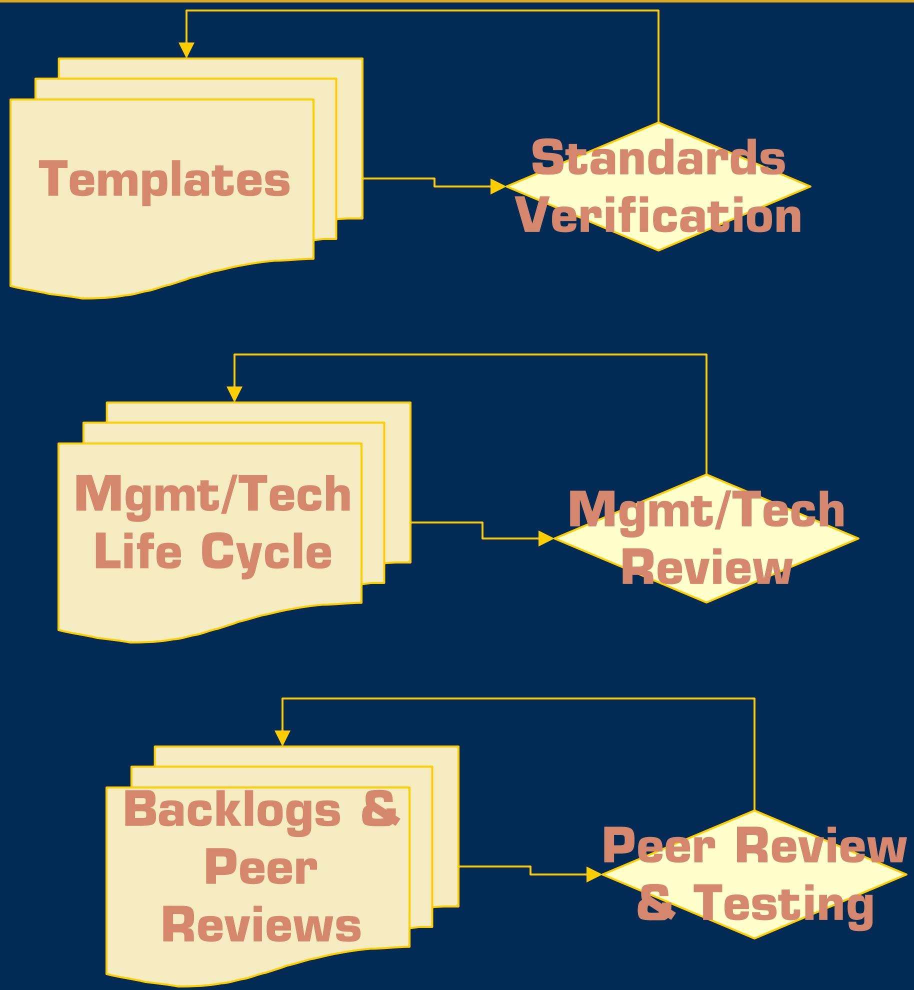
PPQA Concepts in Work Products

- Standards Verification performs process checks against company's own standards
- Engineering Reviews perform integrity checks on designs, analyses, and solutions
- Peer Reviews & Testing perform product checks on code and code-based work



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All Other Processes

- All other practices within process areas have been distributed into and made seamless with company planning and engineering activities.
- Some practices are performed once and passed through with each project review.
- Some practices are addressed by merely including an item on a meeting agenda.

AGILE CMMI

Agile CMMI® ™

CMMI® is a registered mark of the Software Engineering Institute

QA's Job in the New Abstraction

- QA's real job is to ensure certain information is generated to assure that processes are followed.
- There may be no need for QA to get mired in the specifics of development.
- By collaborating with developers on producing what QA needs,
  - the every-day hour to hour activities of development can become part of development activities and
  - QA can be left to monitor the overall effectiveness of the project's processes and feed back process improvements.

Scalable QA in a Scalable Project

- In a well integrated project:
  - generating the data QA needs would merely be a report that runs every so often querying certain tables and build repositories.
- A QA program at this level of abstraction is:
  - infinitely scalable to any project
  - as long as there's the will to cooperate
  - for the purposes of benefiting the business.

CMMI with Scrum

- Product Backlog and Planning
- Sprint Backlog and Planning
- Resource Allocation
- WBS
- Daily Team Meetings
- Peer Reviews and Inspection
- Sprint Review

Product Backlog and Planning

- The product backlog is defined by the **product owner** and managed by the Scrum master.
- Defines High Level Requirements and sets priorities.
- Defines high level work break down structure.
- May define high level release schedule.

- REQM
- PP
- PMC
- CM
- GP 2.2, 2.3, 2.4, 2.7
- (RD, TS, PI, IPM, RISK, DAR)

Sprint Backlog and Planning

- Breaks the product goals down into demonstrable goals. This is usually at the use case level.
- Tasks are broken down into hour-based estimates, anything over 16 hours was broken down into smaller pieces.
- The team creates tasks, estimates and determines who is going to do what, everyone commits to the feasibility of the plan.
  - What can be done in 30 days with the resources we have at our disposal?

- REQM
- PP
- PMC
- CM
- GP 2.2, 2.3, 2.4, 2.6, 2.7
- (RD, TS, PI, VAL, VER, IPM, RISK, DAR)

Resource Allocation

- Managed by the team, as members commit to getting the work done.
- Members **can play many roles at the same time:**
  - Developer, Architect and DBA
  - Developer, Tester and Requirements Analyst
- Member are committed to the project and external noise is minimized.
- The Scrum Master helps alleviate resource contention and noise.

- REQM
- PP
- PMC
- MA
- CM
- GP 2.2, 2.3, 2.4, 2.7
- (RD, TS, PI, IPM, RISK, DAR)

Work Breakdown Structure

- A Product Goal can be broken down into many **use cases**
  - "The application needs to contain a shopping cart"
- A Sprint Goal satisfies a use case
  - "Allow a registered use to put items into their shopping cart"
  - "Allow a user to update the quantities in the shopping cart"
- Each sprint goal is demonstrable, releasable functionality.
  - Show that this use case works, and has been tested and could be released as functionality

- REQM
- PP
- PMC
- CM
- GP 2.2, 2.3, 2.4, 2.7
- (RD, TS, PI, IPM, RISK, DAR)

Daily Team Meetings

- Quick 15-30 Minute Stand up Meetings.
- Answer 3 Questions:
  - What have you done since the last meeting ?
  - What are you going to do before our next meeting ?
  - What issues are you having that are impeding progress ?
- Daily Inspection and Visibility into team progress.
- Daily Issues Management and Resolution.
- Daily Project Command and Control within the self managing team.

- REQM
- PP
- PMC
- MA
- PPQA
- CM
- GP 2.2, 2.3, 2.4, 2.6, 2.7, 2.8, 2.9, 2.10
- (RD, TS, PI, IPM, RISK, DAR)

Peer Review and Inspection

- Peer reviews keeps the team members honest.
- Peer reviews are about **mentoring, not policing**.
- Complete **checkpoints and tollgates** along the project road map that can be done iteratively and kept **non-invasive.**

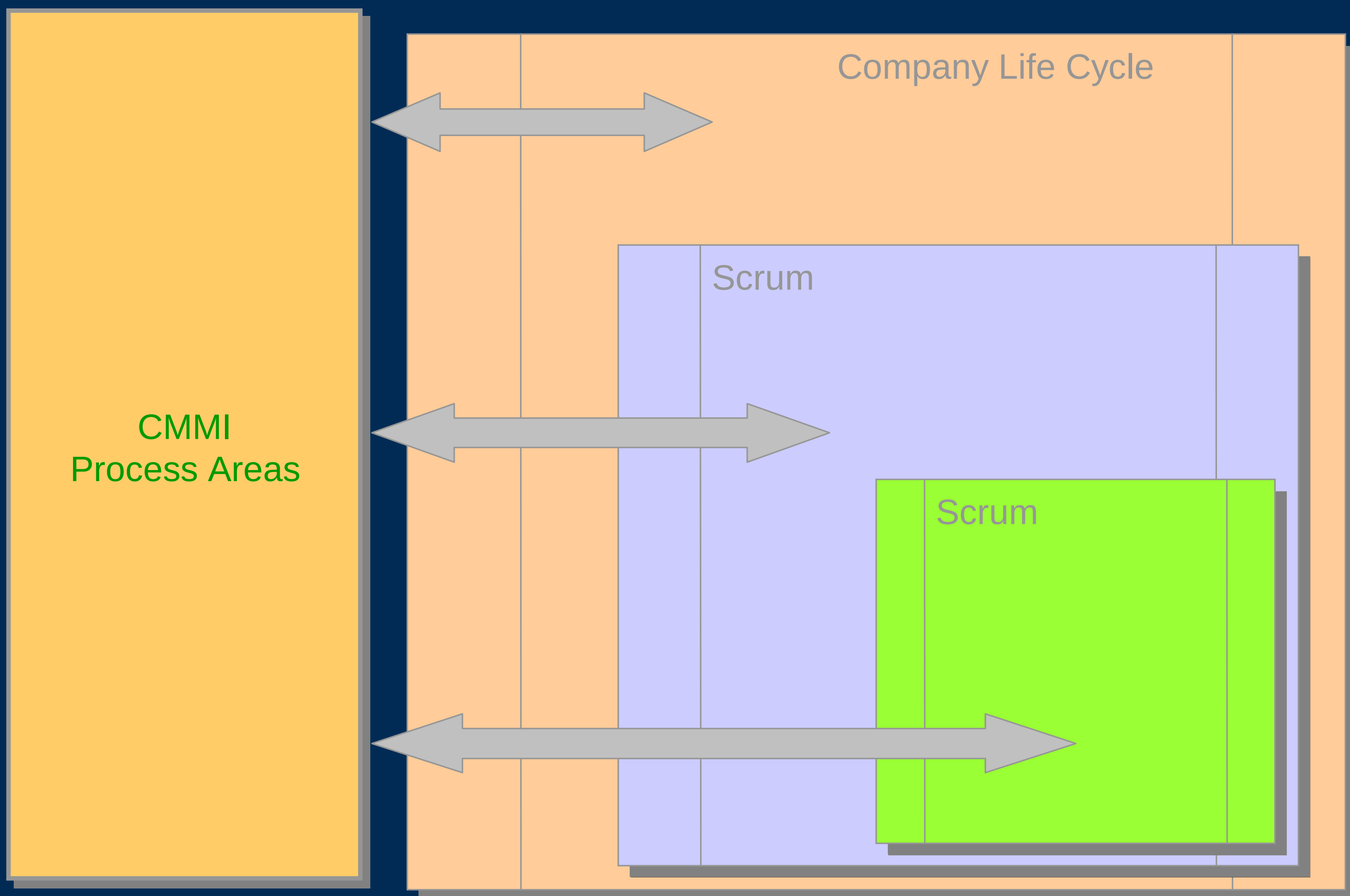
- REQM
- PMC
- MA
- PPQA
- CM
- GP 2.6, 2.7, 2.9, 2.10, 3.2
- (RD, TS, PI, VAL, VER, IPM, RISK, DAR)

Sprint Review

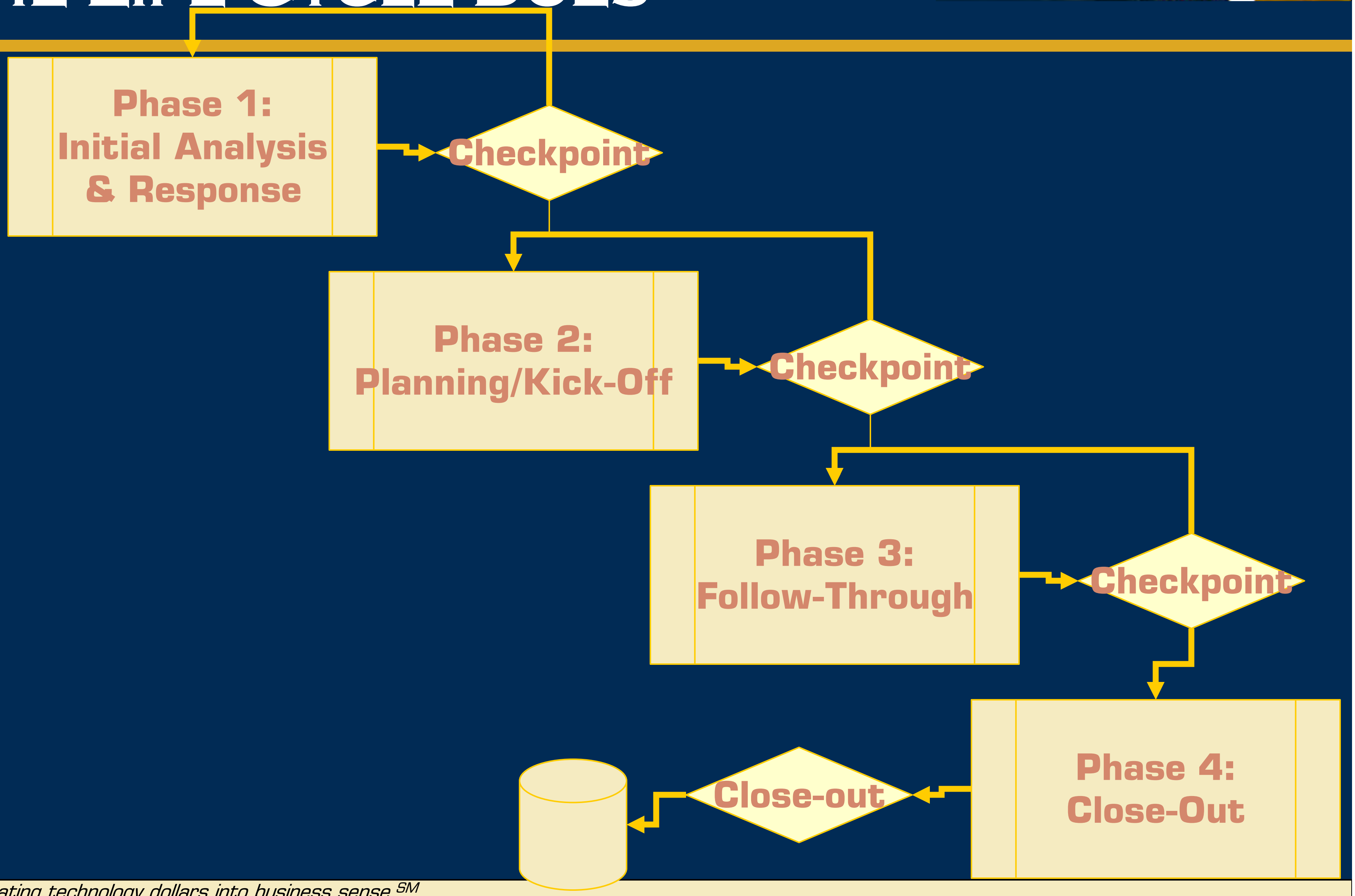
- The Sprint review is a form of validity check-it is determined that the right product is being built.
- Covers whether the product was built right because a working version of the product is giving a viewing to the product owner.
- Product Owner (s) decides if functionally and quality are sufficient to be released

- REQM
- PMC
- MA
- PPQA
- CM
- GP 2.6, 2.7, 2.9, 2.10, 3.2
- (RD, TS, PI, VAL, VER, IPM, RISK, DAR)

Scrum Summary



What Scrum Doen't Cover, The Life Cycle Does



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Conclusion

- Reversing Common Misconceptions About Agile
- Re-Cap
- References
- Q&A

Reversing Common Misconceptions About Agile

- Lightweight/Agile is *not* about eliminating processes.
- Lightweight/Agile *is* about sufficient processes to achieve the project's objectives, but only those processes that are necessary.
- QA and other development processes have not kept up with the changes in development methods or technologies.
- Agile processes have everything the agile project needs to get accomplished.

Re-cap

- History of QA Abstractions
- Context of the Role of QA
- Mutual Distaste Between Lightweight Developers and Process Discipline Practitioners
- Create processes that Promote Productivity
- Middle Ground Where Diligently Followed Lightweight Methods Find Mutually Beneficial Ground with Process Discipline
- Result: Excellent Software of Very Good Value.

RE-CAP

- Today's s/w market is not that of 15+ years ago.
- Traditional QA fails on s/w because the manufacturing model for development is a failure.
- QA must be integrally aligned with development processes and business goals to survive in today's market.
- Agile development processes will survive because they're more consistent w/SW realities.
- Agile can be disciplined if discipline can be agile.

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Lessons Learned in the Engineering of Process Performance Models on the Journey to Higher Maturity Levels

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Common Systems Engineering Management & Technical Issues

Critical Program Performance Challenges….

- Obtaining a realistic understanding and managing internal and external customer requirements.
- Lacking verified and validated techniques of measuring, controlling and balancing cost and performance requirements.
- Hiring the “right staff” in time to evaluate and implement emerging technologies.
- Maintaining ever-increasing program profitability goals due to the impact of emerging administration and technical issues, risk, and changing customer environments.
- Sustaining multi-year technical service and product support levels is impacted by increases in costs, staff transitions and changing customer requirements.

Background of Journey

Rationale for Initiating Journey

Faced with extreme challenges of maintaining profitability while managing increasing performance costs and concurrently responding to a dynamically changing customer environment

Organization Overview

Organization supported customer by performing on-site and off-site engineering and scientific services and product development for a wide assortment of space based platforms.

Kick-Off Activity

Multi-domain leadership team assembled to plan the multi-year journey to higher maturity levels. The initial version of the plan launched pilot projects in the small software development organization followed by support functions of finance, procurement and HR.

Obstacles

The organization faced initial obstacles of resources to construct a framework to integrate key program and technical functions as well as staff training in the CMMI®.

Engineering Approach to Developing a Program Performance Model

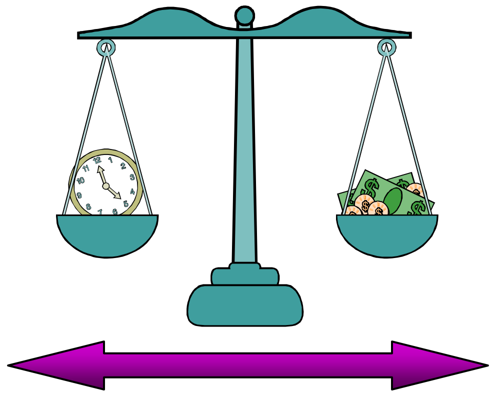
The leadership team, composed of engineers, developers and scientists, constructed the framework for the program performance model using SE Vee life cycle model.

Application of the practices in the CMMI® Process Areas (PAs) were used across the program and projects to implement the relevant phases in the SE Vee model.

Program Performance Model

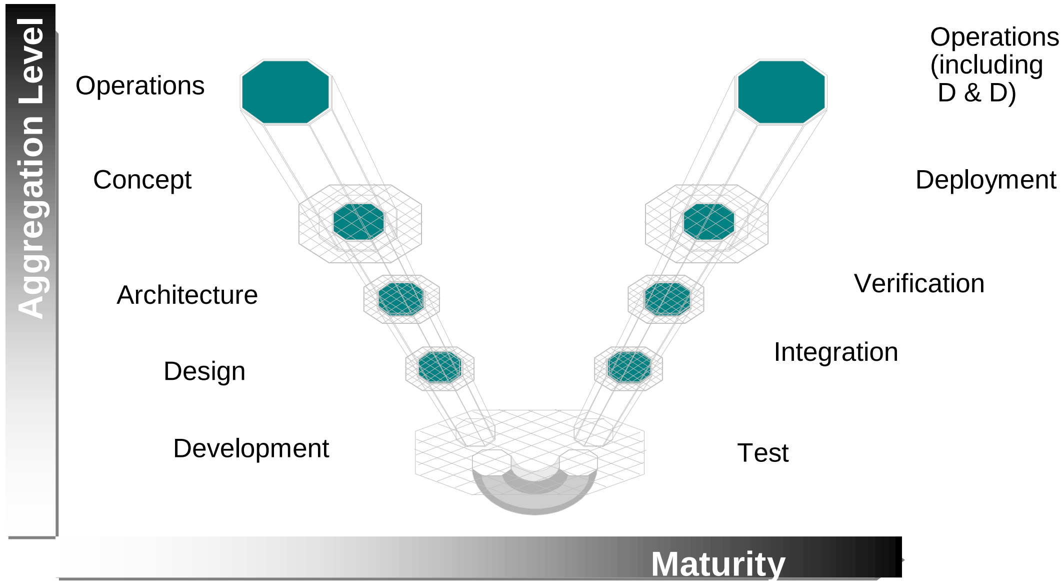
- Functioned as a risk management tool
- Balanced cash flow, staff size, product quality and customer satisfaction
- Sustained service levels and technical performance at planned costs

Challenges in Developing the Program Performance Model



Time Factors	Cost Factors
Realistic understanding of continually evolving customer environments	Exponential increase in costs downstream
Developing and implementing validated techniques to balance cost and performance	Mismatch in technical performance requirements versus program budget
Availability of global rapidly emerging technologies	Inflexible, non-scalable designs
Impact of operational changes	System requirements obsolete
Life cycle planning	O&M infrastructure costs vs. service levels
Staffing	Unfilled positions lower revenue

About the SE Vee Model



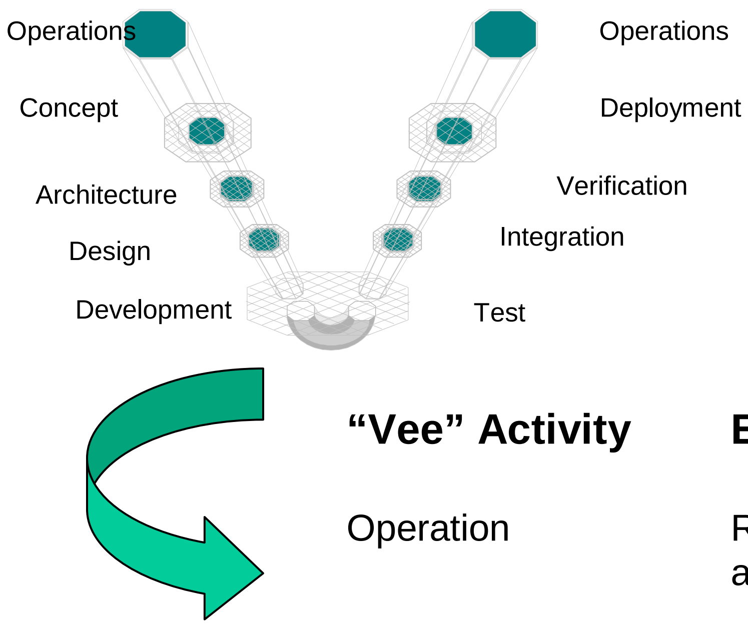
- The SE Vee Life Cycle Model presented to the Texas Board of Professional Engineers, 1999, by Arunski, Martin, Brown and Buede.

- The phases in the Vee are traditionally applied to engineering products and services such as weapons systems, communications networks and technical support.

- In any program, phases in the Vee may not be performed or applicable or may exist in numerous projects at different times.

- Key infrastructure functions, such as finance, contracts, and HR benefit from implementing the same engineering discipline and activities as technical projects.

Engineering of Program Performance Models



"Vee" Activity	Example Critical Support Functions
Operation	Resources (space, accounting, BP systems)
Concept	Business goals performance intervals
Architecture	Structure of business performance interfaces (receivables, quality measures inventory, growth)
Design	Performance constraints for cash flow, service level performance, staff size
Development	Increments to support planned site expansion

Engineering of Program Process Performance Models

SE Vee Phases

Operations

Concept

Architecture

Design

Development

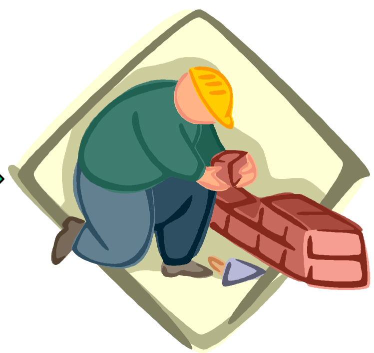
Verification

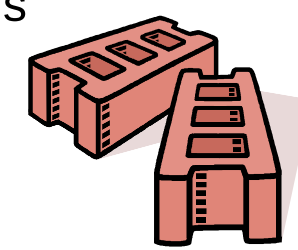
Integration

Test

Operations

Deployment





CMMI Process Area Categories

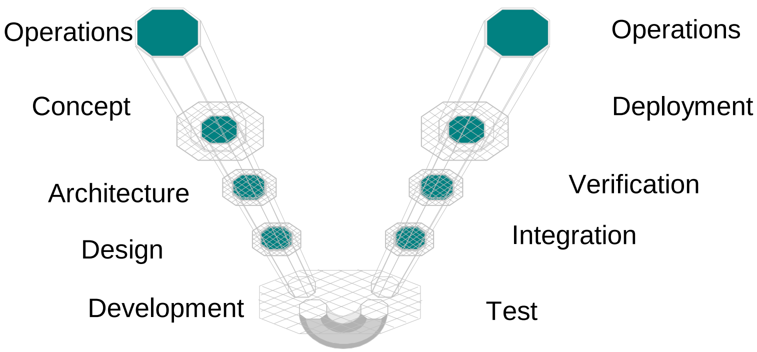
Project Management
(Project Planning, Project Monitoring & Control, Risk Management, Integrated Project Management, Integrated Teaming, Integrated Supplier Management, Quantitative Project Management)

Process Management
(Organizational Process Focus, Organizational Process Definition, Organizational Training, Organizational Process Performance, Organizational Innovation and Deployment)

Engineering
(Requirements Management, Requirements Development, Technical Solution, Product Integration, Verification, Validation)

Support
(Configuration Management, Process & Product Quality Assurance, Measurement & Analysis, Causal Analysis & Resolution, Decision Analysis & Resolution, Organizational Environment for Integration)

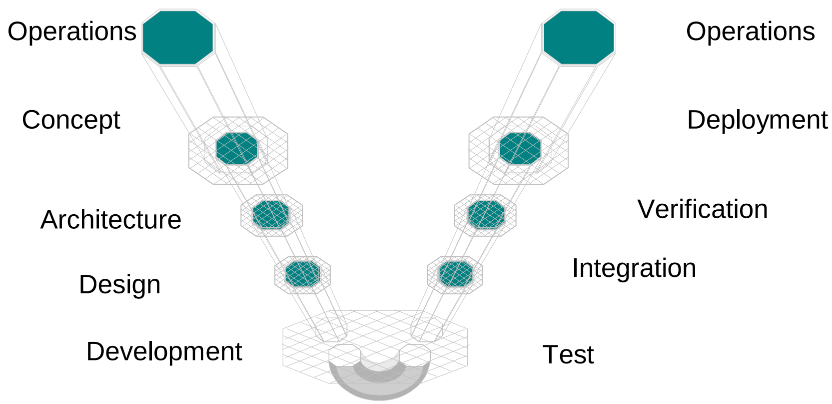
Engineering of Support Function Framework

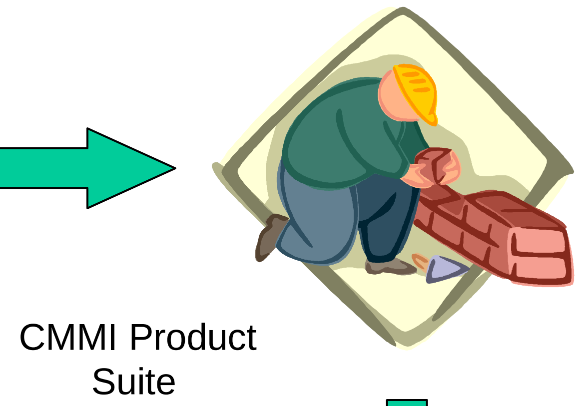


CMMI Product Suite

“Vee” Phase	Example Key Support Functions	Key CMMI PAs
Operations	Resources (space, BP systems, staffing levels)	M&A, PP, RSKM
Concept	Business goals performance intervals	M&A, RD
Architecture	Structure of business performance interfaces (cash flow, quality measures, inventory, growth, .etc.)	M&A, TS, PI
Design	Performance constraints for cash flow, service performance, staffing	M&A, RD, RM, TS
Development	Builds to support planned market and program expansion	M&A, RD, PP, RSKM

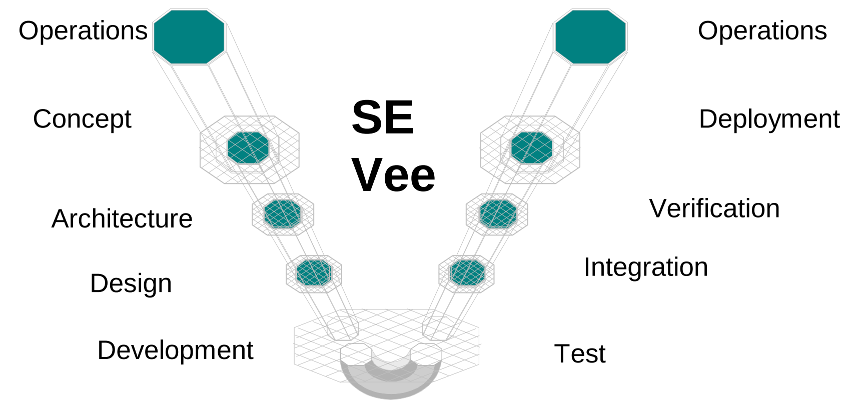
Engineering of Support Function Framework (Continued)





“Vee” Phase	Examples Key Support Functions	Key CMMI PAs
Test	Finance test scenarios and databases	M&A, VER, VAL
Integration	New interfaces of components (acquisitions) for growth goals, finance and HR functions	TS, PI
Verification	Invoicing and staffing processes	M&A, VER, VAL
Deployment	Perfective and adaptive maintenance of support functions	PP, PMC, TS
Operations	Forecasting of staffing and facilities costs	PP, PMC, QPM, OPP, OID

Overview of the SE Vee, CMMI Process Areas and Business Goals



CMMI
Product Suite

Key Process Areas
Measurement & Analysis, Project Planning, Project Monitoring & Control,
Risk Management, Quantitative Project Management, Organizational Innovation & Deployment,
Causal Analysis & Resolution, Decision Analysis & Resolution…

Practices

Program Business Goals

Support	**Technical**	**Customer Satisfaction**
Invoicing Procurement Contracts Staffing	Latent Defects	Customer Satisfaction

Example of Balancing Cost and Technical Performance in a Small Setting

Key CMMI Process Areas
Measurement & Analysis, Project Planning, Project Monitoring & Control,
Risk Management, Quantitative Project Management, Organizational Innovation & Deployment,
Causal Analysis & Resolution, Decision Analysis & Resolution…

Practices

Program Business Goals: **Support** → **Technical** → **Customer Satisfaction**

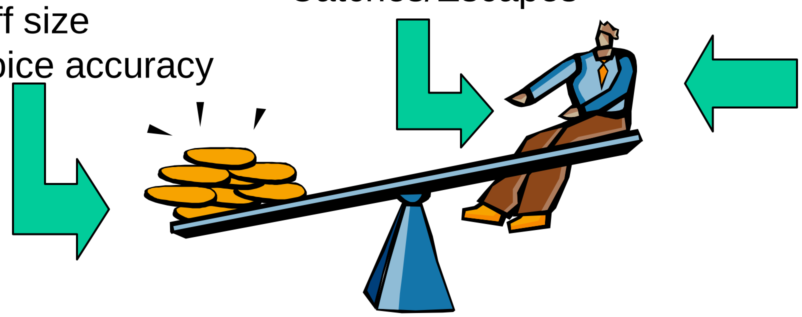
Key Measurements:

- Support: Invoicing, Procurement, Contracts, Staffing
- Technical: Latent Defects
- Customer Satisfaction: Customer Satisfaction

Process Performance Intervals

Staff size
Invoice accuracy

Catches/Escapes

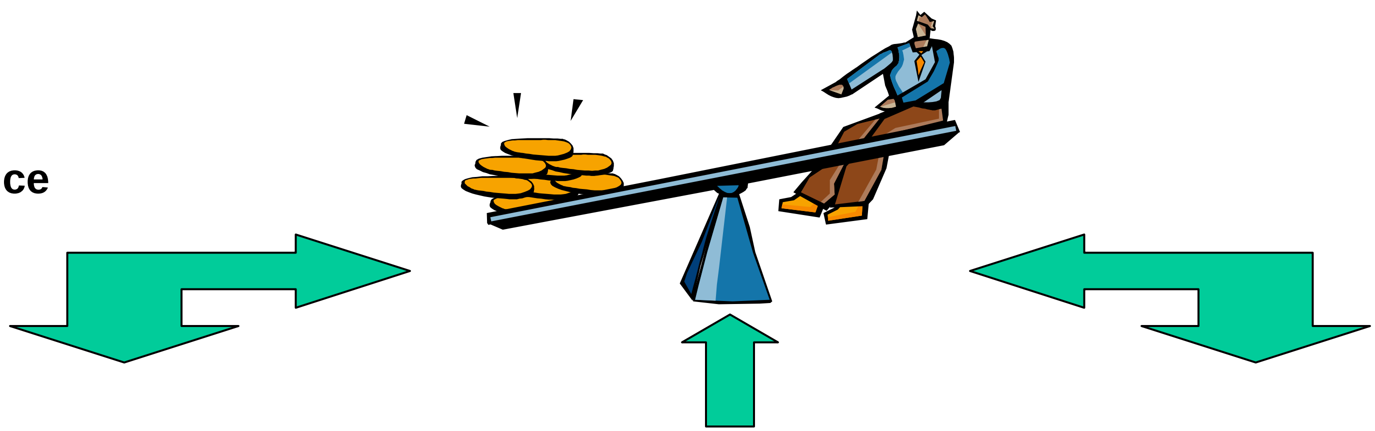


Customer Satisfaction

Case Study Example of Balancing Cost and Technical Performance in a Small Setting (Continued)

	Support	Technical	Customer Satisfaction
Program Business Goals	**Support**	**Technical**	**Customer Satisfaction**
Key Measurements	Invoicing Procurement Contracts Staffing	Latent Defects	Customer Satisfaction

Process Performance Intervals



-6.0% ≤ Staff Size Accuracy ≥ 9.0% -8.1% ≤ Invoice Accuracy ≥ 6.5%	0 ≤ Latent Defects ≥ 3	4.5 ≤ Customer Satisfaction ≥ 5.0

Lessons Learned During the Journey

- Focus on defining business goals and related measurements for the organization for the **entire** period of program performance.

- Plan and implement the applicable CMMI PA practices in projects across the
organization sooner rather than later as retrofitting is difficult.

- Measurement processes should focus on forecasting yearly costs, required technical performance levels, quality goals and program support levels.

- Apply SE tools and techniques, such as alternative evaluations, performance simulations, requirements definition and risk analysis across the infrastructure functions as well as technical services using practices in the CMMI.

- Provide CMMI training to classes with diverse backgrounds to enhance team building.

Lessons Learned (Continued)

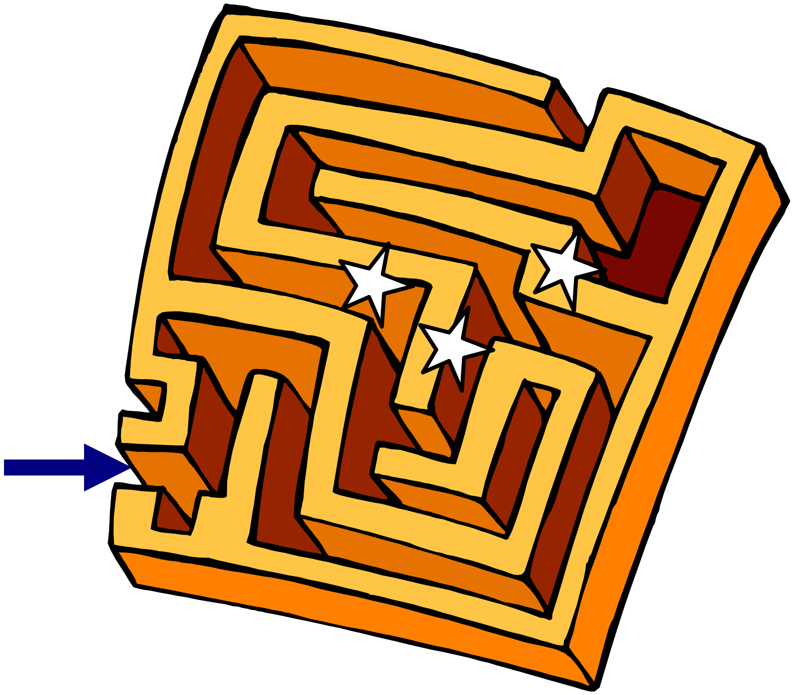
- The phases in the SE Vee provide a useful and applicable life cycle model for engineering of a framework to integrate management and technical practices across a program.
- The SE Vee is very adaptable to small settings and applies to support services, such as finance, contracts and HR.
- The practices in the current version of CMMI Process Areas cover a large percentage of the phases in the Vee.
- Customer advocacy and participation in an appraisal is very advantageous for all.
- For best results, focus on first defining business goals and relevant measurements to implement continuous process improvement to achieve a program performance model to balance cost and technical performance via the CMMI.
- Expect multi iterations during the measurement and analysis activities before key sub-processes are controlled.

Getting Lost on the Way to Levels 4 and 5

Kathy King
CSM

Background

- **Appraisal results show some common weaknesses for Level 4 and 5**
- **Tracing back….**
  - Time pressures to get the level
  - Wrong decisions at key points
  - Relationship to current processes ignored
  - Statistics takes precedence over good business decisions
- **How to avoid missteps**
  - Have a guide
  - Integrate new activities with current activities
  - Interpret for your environment



Agenda

- **Commonly Cited Level 4 and 5 Problems**
- **Key Decision Points Along the Way**
  - How Level 4 and 5 processes are developed
  - Compose the Define Process
  - Selecting Subprocesses for Statistical Management
  - Choice of Statistical Techniques
  - Statistical and Quantitative Management
  - What Characterizes Level 4 Institutionalization?
  - Using Six Sigma for Maturity Level 5

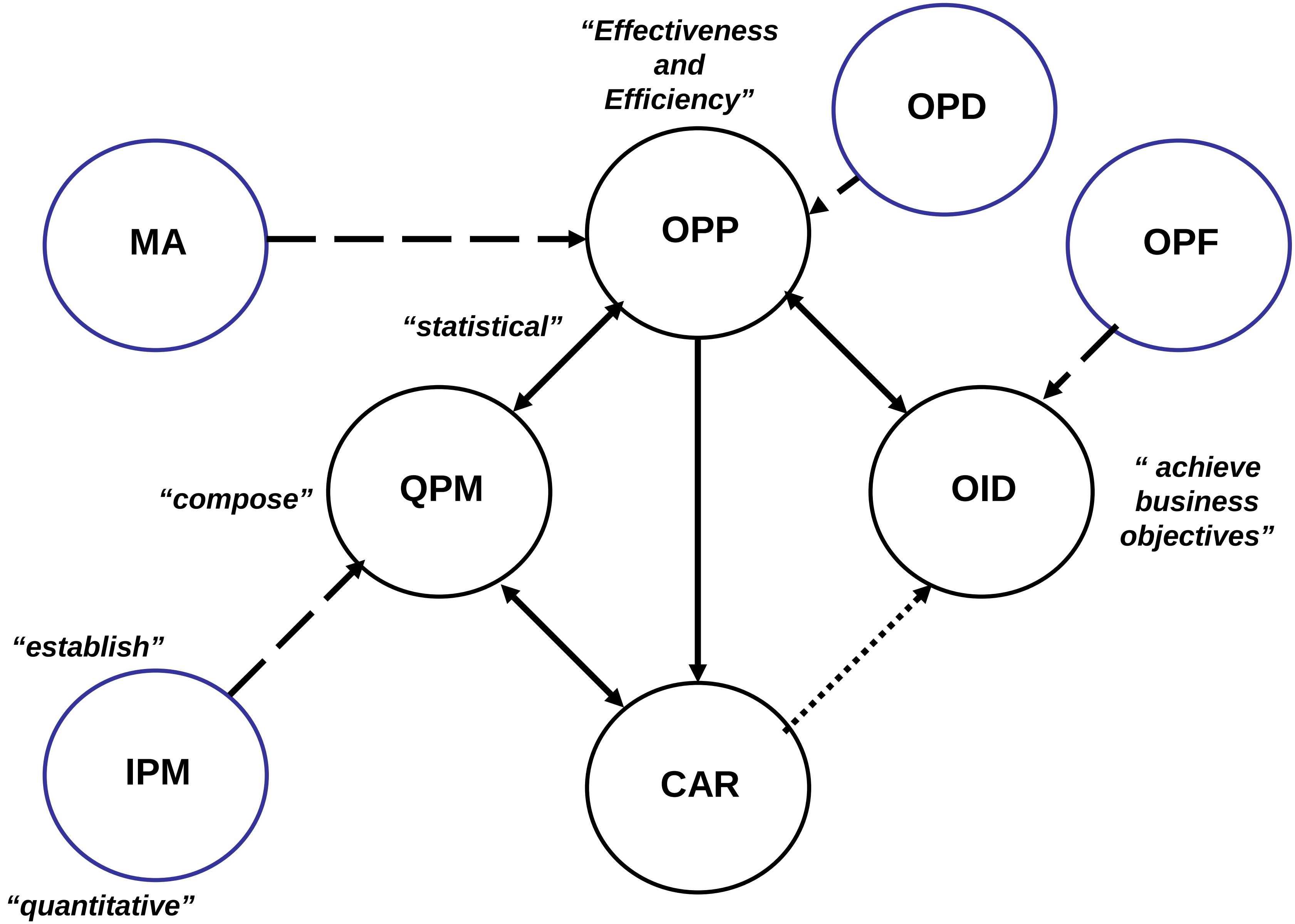
Commonly Cited Level 4 and 5 Problems

- **Business goals not aligned with measures**
- **Failure to revise measurements (or question validity)**
- **Relationship between statistically managed subprocesses and business goals is unclear**
- **Failure to perform risk mitigation when desired results do not match expected results**
- **Models aren’t used to manage attainment of critical project objectives**
- **Statistical techniques are used incorrectly**
- **Failure to question and or evolve measurements**
- **Level 4 and 5 activities are unrelated (including Six Sigma activities)**

How Level 4 and 5 Processes are Developed

- ☐ **We develop new processes, add them to our Process Asset Library, and transition projects as needed**
- ☑ **We evolve existing processes to include level 4 and 5 activities where appropriate**
  - **Level 4 and 5 activities do not replace existing processes**
  - **Level 4 and 5 activities are extensions of existing Process Areas**
    - Measurement
    - Project Management
    - Process Improvement

How Processes Evolve



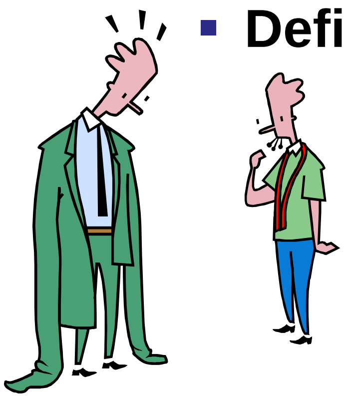
Compose the Defined Process

How do you compose the defined process?

☑ **We use our project objectives to determine our defined process**

☐ **We follow the tailoring guidelines to determine our defined process**

- **If project objectives (desired) are not achievable with historical achievements (expected)**
  - Current tailoring won't achieve different results
  - Risk needs to be identified and analyzed (CAR or Six Sigma could help)
  - What needs to be added or changed to achieve project's objectives?
- **Defined process expectations may not be known**
  - Can model be used to monitor risk?
  - How will you gain insight into the impact of different processes?

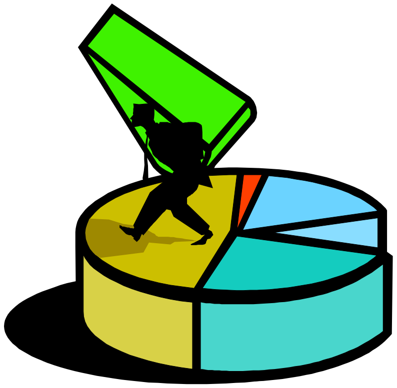


Selecting Subprocesses for Statistical Management

☑ We select subprocesses that are critical to meeting our project objectives

☐ The subprocesses we select are consistent across the organization

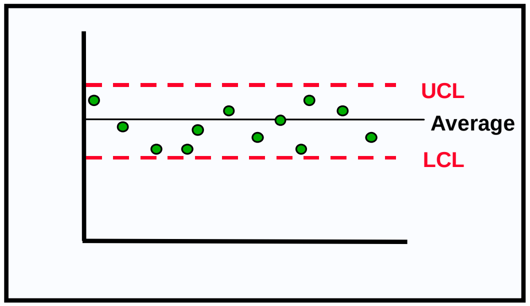
- Project needs and organizational needs may be different – contract type, customer, product needs
- Combining data across projects to increase confidence is problematic
  - Variation is usually increased
  - Valuable insight into needed process performance can be lost



Choice of Statistical Techniques

- ☐ **We rely primarily Statistical Process Control (SPC) techniques**
- ☑ **We encourage a wide range of statistical techniques**

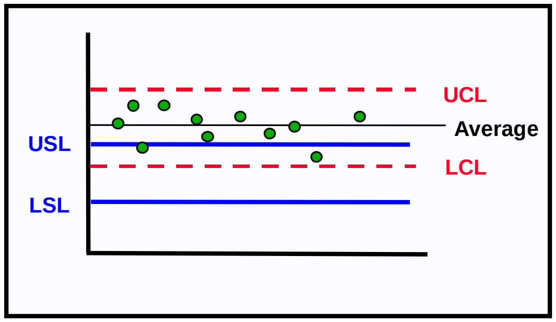
- **SPC techniques work well for some situations**
  - Data should be time independent
  - Sufficient data exists for confidence
  - Calculated control limits are useful
  - Collect enough information so that data can be repartitioned if needed



- **SPC can be use to verify results of other techniques**
  - Design modeling and simulation with manufacturing SPC
  - Part-time resource allocation and productivity

Statistical and Quantitative Management

- ☐ Statistical characterization indicates statistical management
- ☑ Statistical management infers acceptance of statistical expectations

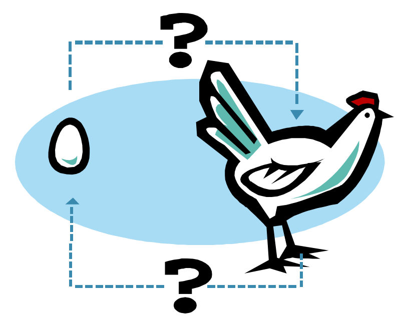


  - If expected results will not satisfy desired results – quantitative management makes sense
  - Statistical management may not be good business in all cases
    - Expected variation is unacceptable
    - Data is insufficient to provide sufficient confidence

Organizational Role in Quantitative Management

- ☑ **The project determines what will be managed using statistical and other quantitative techniques**
- ☑ **The organization sets guidelines for projects as to what will be managed using statistical and other quantitative techniques**

- **Organizational role**
  - Need to monitor certain indicators at organizational level
  - Provides historical project data as a planning asset to projects
- **Project role**
  - Satisfy customer needs and expectations
  - Organizational obligation for insight into future projects (CAR, OID)



What Characterizes Level 4 Institutionalization?

- ☐ We have demonstrated use of statistical and other quantitative techniques across the entire lifecycle
- ☑ We have collected enough data and used techniques long enough to determine if it is working
- ☐ It's time for the appraisal

- **Is it working?**
  - Projects are able to predict and insight is valuable
  - Unexpected failures are analyzed – revision to measurements or techniques
  - Stakeholder involvement and confidence is apparent

- **It makes good business sense**
  - Intent of model is satisfied
  - Business and Quantitative objectives are integrated

Using Six Sigma for Maturity Level 5

We've used Six Sigma long before we introduced level 4 activities

☐ **Six Sigma projects satisfy Maturity Level 5 activities**

☑ **A subset of our Six Sigma projects satisfy Maturity Level 5 activities**

- **Six Sigma has numerous interpretations**
  - Some rely on statistical understanding
  - Some require use of statistical techniques
- **Look for Six Sigma projects that support Maturity Level 4 activities**
- **Include cost/benefit estimations and tracking to achievement of organizational/project business objectives**

Summary

- **Understand the differences between Level 4 and Level 3 behaviors**
- **Understand the relationship and evolution of Level 3 to Level 4 activities**
  - Project Management
  - Process Improvement
  - Measurement
- **Interpret the activities in the context of your business**
  - Level 4 and 5 activities need to make good business sense
  - Understand the big picture of CMMI Level 4 and 5

Q&A

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CMMI ®

The CMMI® Product Suite and International Standards – An Update

Fifth Annual CMMI Technology Conference and User Group - November 15, 2005

® CMMI is registered in the US Patent & Trademark Office by Carnegie Mellon University

Sponsored by the U.S. Department of Defense

Agenda

What's Happening in the International Standards Arena?

Capitalizing on Synergies with Selected International Standards

Current Status

What's Happening in ISO?

Work wrapping up on process assessment model for 12207 – Software Life Cycle Processes (15504-5) – to be published Q106,

Work beginning on process assessment model for 15288 – System Life Cycles Processes (15504-6) – to be published Q308 (estimate)

Work beginning to add organizational maturity construct to 15504 (will be published as 15504-7) – to be published Q308 (estimate)

Revision of 15939 - Software Measurement Process - to encompass systems and software,

Work towards eventual "harmonization" of 12207 and 15288 – this COULD result in a single IS addressing both,

Work beginning on applying 12207 to Very Small Enterprises

Work beginning on Certification of Software Engineers

What Does This Mean!?

National boundaries (and all which that implies) continue to become less relevant to international commerce,

More pressure to either use international standards directly or ensure that “local” standards have meaningful connectivity to relevant international standards.

More pressure for “reciprocity” agreement

Impact of Globalization Pressures -1

SEI involvement in relevant international standard work since early 90s,

CMMI Product Suite manifestations:

- A-spec for CMMI Product Suite cites as reference documents "Applicable ISO/IEC documents, including ISO/IEC 12207 and ISO/IEC 15504"; contains two "line item" requirements citing 15504,
- ARC draws heavily on 15504-2 requirements,
- SCAMPI (A) is largely 15504 compliant,
- Nine standards (sector, professional society or international) are cited in the CMMI model reference appendix,
- Six standards (sector, professional society or international) are cited in the CMMI model glossary "order of precedence"

Impact of Globalization Pressures -2

(2000) Publication of Spice for Space method and model (S4S) by ESA for use by the European space industry,

(2001) Publication of Spice-9000 for Space method and model (S9kS),

(2003) Publication of mappings relating CMMI to 9001 by Boris Mutafelija and Harvey Stromberg,

(2004) Publication of mappings relating CMMI to 9001 and 12207 by Software Quality Institute,

(2004) Breakout session on dual outcome SCAMPI appraisals at SCAMPI Lead Appraiser workshop

(2005) Publication of Automotive SPICE (ASPICE) – a derivative of 12207 for use by automobile manufacturers to select suppliers,

(2003-5) Informal SCAMPIs with 9001-relevant outcomes reported by individual SCAMPI Lead Appraisers

Synergy With Selected International Standards -1

Identify areas where there are opportunities for synergy between key international standards and the CMMI Product Suite

Exploit these opportunities by developing appropriate work products and/or liaising with appropriate individuals and organizations

Synergy With Selected International Standards -2

Key standards identified to date are

- ISO 900x:2000 family of standards (as well as selected domain derivatives)
- ISO/IEC 12207
- ISO/IEC 15288
- ISO/IEC 15504

Note that 15504 provides a mechanism for establishing important relationships to other important process-related international standards

Revised Approach for 9001

Modified position as follows:

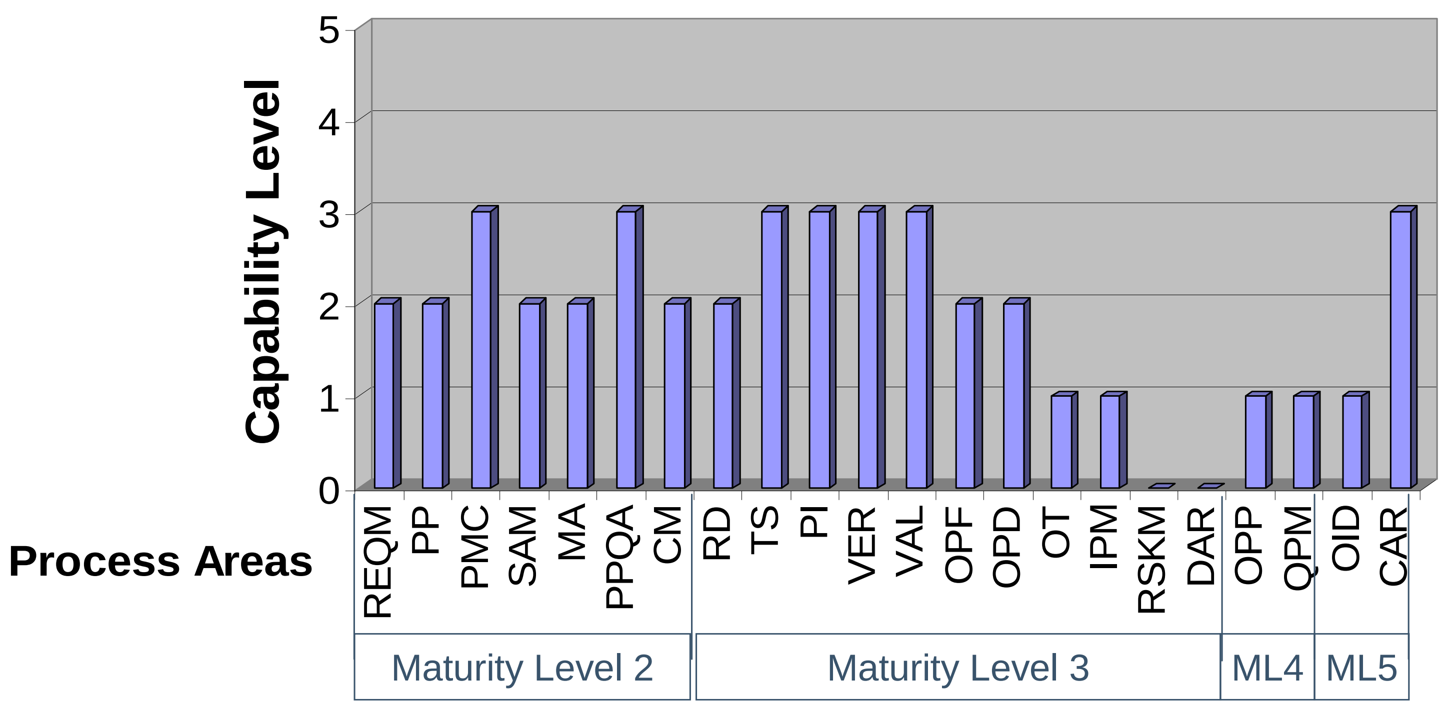
- Current market needs are for 9001-relevant outputs from a SCAMPI as opposed to a 15504 process profile relevant to a 9001 process reference model,
- initial pilots will not focus on 15504 conformance,
- Possibility of 15504 conformance relative to a 9001 process reference model as market needs evolve

Usage Scenarios

Initial pilots this year and next are focused on addressing the following scenarios:

- “we are ***also*** working towards 9001 compliance – how are we doing?
- “we have already achieved 9001 certification and we would like to see how our [CMMI initiative, 9001 certification] is supporting our [9001 accomplishments, CMMI initiative]”
- Variations of above:
  - If we are CMMI maturity level x, what are the implications for 9001 certification?
  - If we are 9001 certified, what are the implications for CMMI maturity?

CMMI - ISO9001:2000 Capability Profile by Equivalent Staging



Courtesy of Rout et al, QualCon 2004

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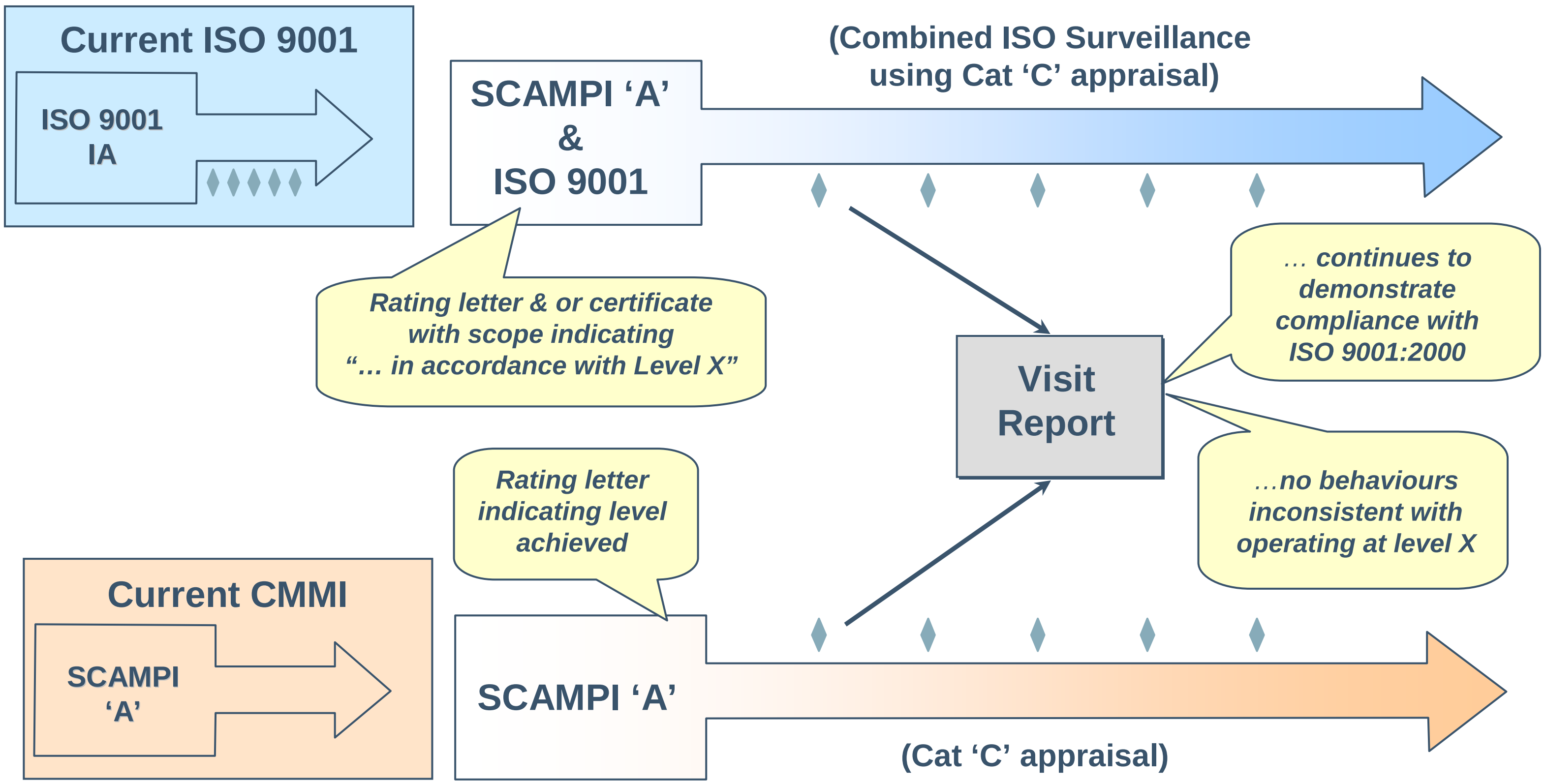
The possible options for assessment and surveillance



Current Status

October 2005 - “Shadow appraisal” as an initial step towards identifying and capitalizing on synergies with 9001,

2005-6 - Possible collaboration with US Tag to TC176 for development of guidance document useful to 9001 and CMMI communities,

February 2006 - Full SCAMPI appraisal to test ability to generate 9001 outcomes as well as a 12207 process profile generated in compliance with 15504-2,

Technical Note (s) to document lessons learned and provide guidance

The Application of IEEE Software and System Engineering Standards in Support of Software Process Improvement

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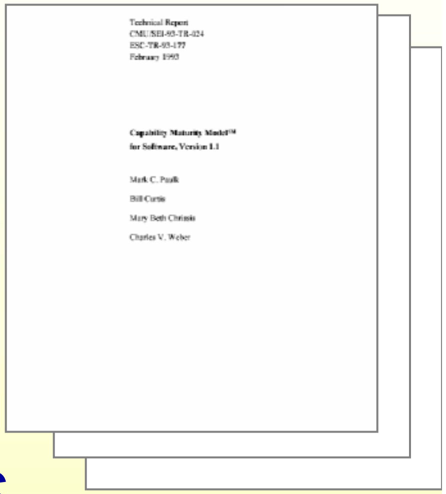
In Other Words…

Using IEEE Software Engineering Standards to:

- Define software engineering (SE) processes.
- Ensure CMMI-SW Level 2 compliance.
- Perform software engineering gap analyses.
- Improve existing SE processes.


Technical Report
CMU/SEI-93-TR-024
ESC-TR-93-177
February 1993

Capability Maturity Model™ for Software, Version 1.1

Mark C. Paulk

Bill Curtis

Mary Beth Chrissis

Charles V. Weber

Why Process Improvement?

- All those practicing as software engineers should desire to evolve out of the chaotic activities and heroic efforts of a Level 1 organization.
  - *Because no one likes a ‘painful’ work environment -*
- Good software can be developed by a Level 1 organization, but often at the expense of the developers.
  - *People get tired of being the hero -*
- At the repeatable level, Level 2, software engineering processes are under basic management control and there is a management discipline.
  - *Even the most die-hard techie needs time away from work -*

Who Cares?

The Organization

- *Interested in defining sound software engineering practices.*
- *Would like to perform a Gap analysis on existing processes.*
- *Would like to demonstrate CMMI Level 2 capability*.

The Individual

- *Tasked to implement CMMI compliant processes.*
- *Would like to improve existing software engineering capabilities.*
- *Would like to demonstrate CMMI Level 2 capability*.

Why IEEE Standards?

- IEEE Standards can be used as <u>tools</u> to help in the painful process of *'self-documentation'*.
- Many of the *standards provide detailed procedure explanations*, they offer section by section guidance on building the necessary documentation.
- Most importantly, they *provide the best practice* as defined by those from the software development industry who sit on the panels of reviewers.

The CMMI and SWE Standards

The ***CMMI*** is a compendium of software engineering practices, which act as ***the motivator for the continuous evolution*** of improved software engineering processes.

IEEE Standards can be used to ***provide the basic beginning framework*** for software process improvement.

Software and Systems Engineering Standards Committee (S2ESC)

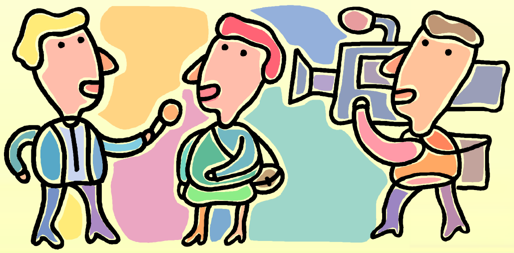
"To provide a family of products and services based on software engineering standards for use by practitioners, organizations, and educators to *improve the effectiveness and efficiency of their software engineering processes, to improve communications between acquirers and suppliers, and to improve the quality of delivered software and systems containing software."*

In 1996 and 1998 S2ESC conducted two web-based software engineering users surveys, the results of these surveys indicated that users perceived the standards provided the most value when applied as guidance in support of software process improvement efforts.

http://standards.computer.org/sesc/

User Feedback/Summary

- Users view ***IEEE software engineering standards*** primarily as reference material to develop their own internal plans.
- ***IEEE SE standards*** are tailored and used to develop internal documentation for compliance measures, namely ***CMMI***.
- There is ***value added*** in the use of the IEEE software engineering standards set in support of process improvement activities.

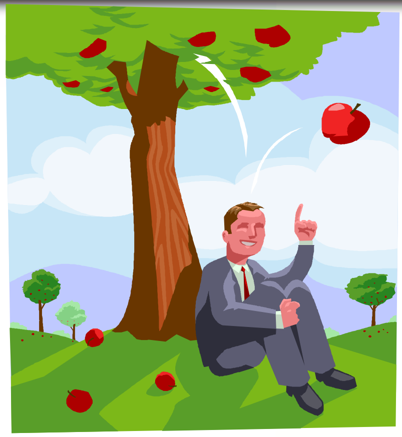


My Personal Goals

- Show how the IEEE set of software engineering standards may be applied to facilitate CMM/CMMI Level 2.
- Examine Strengths and weaknesses of each standard in support of CMM Level 2 requirements.

- Provide recommendations on how the IEEE software engineering standards set may most effectively be utilized to establish software process controls.

The Logic



Assumption 1

The CMMI-SW Staged is an upgrade of the CMM.

Assumption 2

IEEE Standards proved to be an effective support for the implementation of CMM-based process improvement.

Therefore

IEEE Standards provide effective support for the implementation of CMM and CMMISW-based process improvement.

The Basics – CMM/CMMI

- A process is a leverage point for an organization's *sustained improvement*.

- The purpose of the CMMI is to *provide guidance for improving processes* within an organization.

- CMM v1.1 being phased out, CMMI-SW builds on CMM v1.1 and *supports integrated enterprise-wide process improvement*.

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Overview Comparison

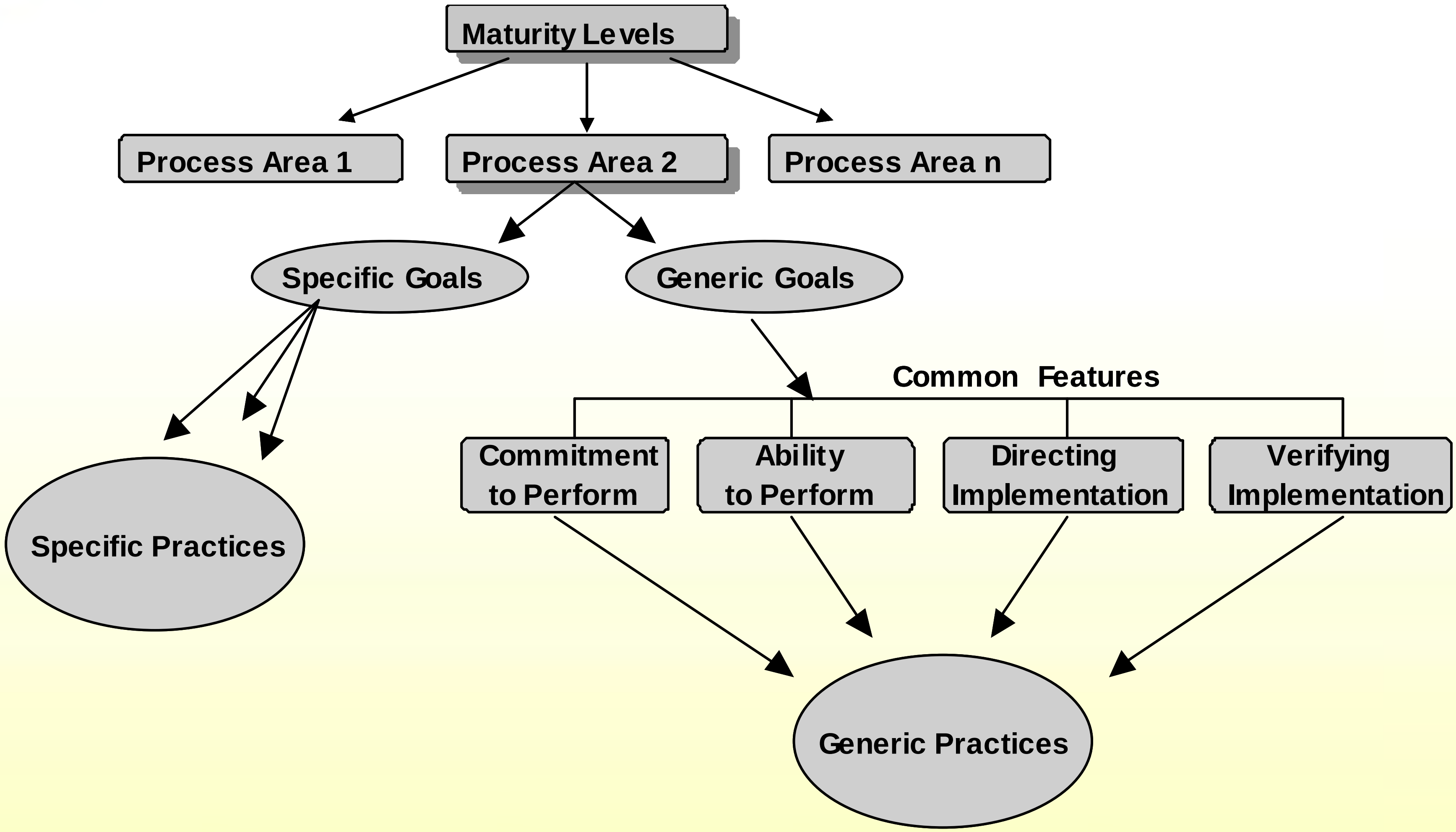
Maturity Level	SW-CMM	CMMI-SW (Staged)
5	Optimizing	Optimizing
4	Managed	Quantitatively Managed
3	Defined	Defined
2	Repeatable	Managed

CMMI-SW (Staged) Level 2 PAs

Maturity Level	Process Area (PA) Name	# of Key Practices
5 Optimizing	Organizational Innovation and Deployment Causal Analysis and Resolution	19 17
4 Quant.Managed	Organizational Process Performance Quantitative Project Management	17 20
3 Defined	Requirements Development Technical Solution Product Integration Verification/Validation Organizational Process Focus Organizational Process Definition Organizational Training Integrated Project Management Risk Management	20 21 21 20 19 17 19 20 19
2 Managed	Requirements Management Project Planning Project Monitoring and Control Process and Product Quality Assurance Configuration Management Supplier Agreement Management Measurement and Analysis	15 24 20 14 17 17 18

Level 2 organizations must demonstrate 125 key practices!

CMMI – Structural Overview



CMMI-SW Level 2 / The Specifics

Requirements Management. Manage requirements associated with a project and identify inconsistencies between the requirements and the project plan and associated work products.

Project Planning. Planning in support of project activities.

Project Monitoring and Control. Processes supporting the effective management of a software project.

Process and Product Quality Assurance. Activities associated with software project oversight.

Configuration Management. Processes in support of the definition, control, review, and reporting of the work products associated with a software project.

Supplier Agreement Management. Processes supporting the acquisition of products from suppliers for which there exists a formal agreement.

Measurement and Analysis. Processes supporting the development, maintenance, and implementation of software project measurement activities.

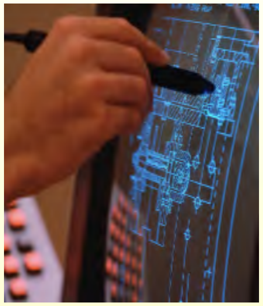
CMMI & IEEE Standards

- **CMMI – Prescriptive *(What)***
  - ✓ Provide guidance for improving the processes within an Organization
- **IEEE – Descriptive *(How)***
  - ✓ To provide a family of products and services based on software engineering standards …

A Logical pairing to reach process improvement goals

IEEE Standards Structure

- The standards *specify format and content* with no recommendation of the exact techniques to be used.
- The standards *represent industry best practices* having been developed by domain experts with broad expert consensus.



- The standards *specify the minimum required contents for each CMMI support document.*

Implementation Recommendations…

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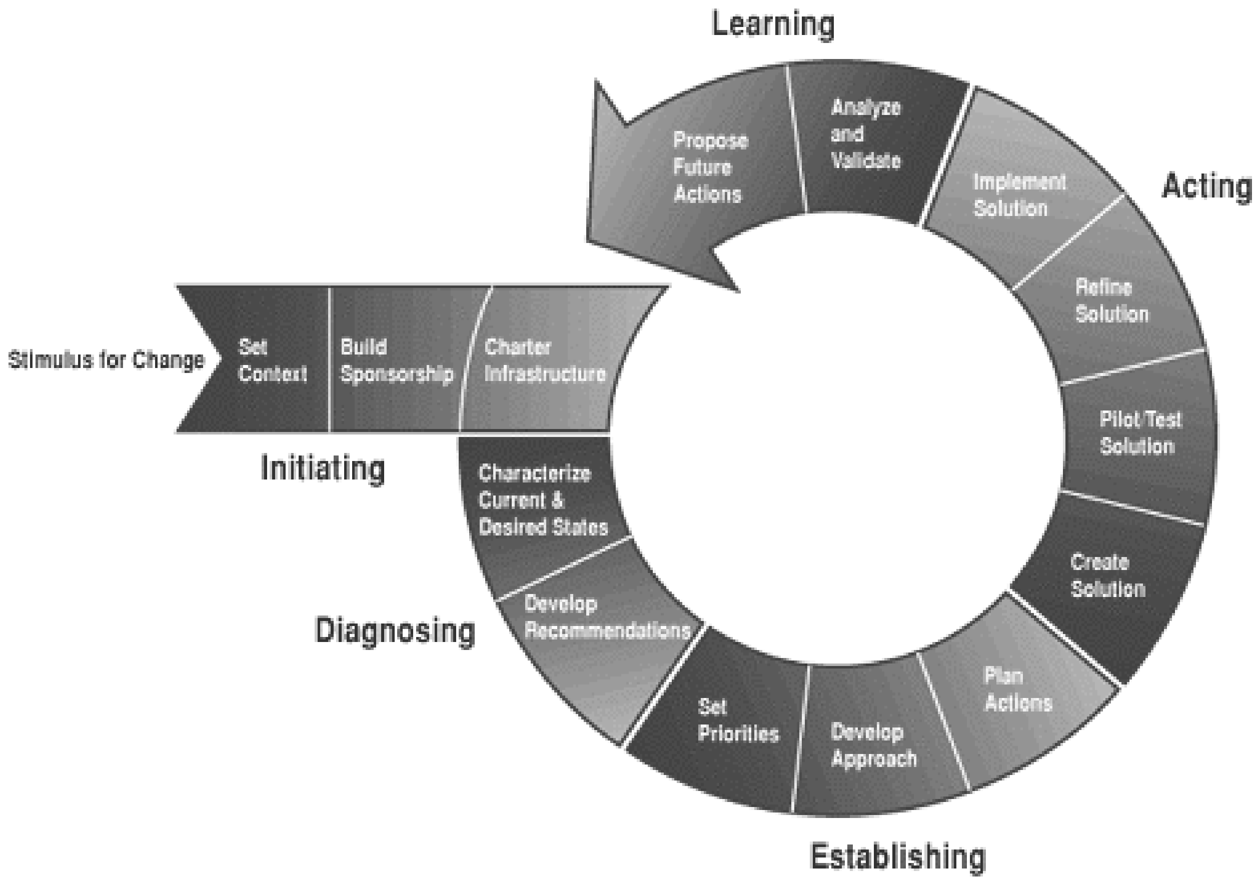
The IDEAL® Approach

Initiate
Diagnose
Establish
Act
Learn



- **Developed to support the CMM/CMMI**
- **Serves a road map to software process implementation and improvement**

Define and Train the Process Team (Initiate)

Identify a group of people who are given responsibility and authority for improving organizational processes:

- Implementing process improvement can be very time-consuming, depending upon the scope and complexity of the effort.
- Expectations for each team member's time commitments and job responsibilities must be modified accordingly to reflect the new responsibilities.
- This commitment should reflect time budgeted for process definition and improvement and any required refresher training.

IEEE software engineering standards provide valuable support to the process team. The standards should be used to help define and document the initial baseline of recommended processes and practices.

Set Realistic Goals (Diagnose)

- The leap from chaos (Level 1) to Level 2 is often the hardest step for many organizations.
- Defining the initial process baseline is key, in order to understand where the organization needs to be; it must first understand where it is.
- Use the CMMI®-SW Level 2 and Level 3 goals to identify areas of weakness or bottlenecks in existing processes. Then refer to each of the appropriate IEEE Software Engineering standards using them as planning tools and as checklists to be considered when determining how to accomplish process completeness.
- It is important to identify which organizational process plans will be developed and the sequence of their development.

Fix Timelines (Establish)

Goal driven process improvement is the most effective. Identify short and long term goals and time periods; associate these goals as schedule milestones.

(0-3 months)

- Identify responsible individuals.
- Identify participating project managers.
- Identify candidate projects.
- Solidify backing of Senior Management.
- Look at existing processes.
- Define the formats for your process plans using IEEE Software Engineering Standards and measure them against the CMMI® requirements.
- Get project members to provide feedback on process plans, review and incorporate feedback.
- Conduct ARC Class C Gap Analysis.

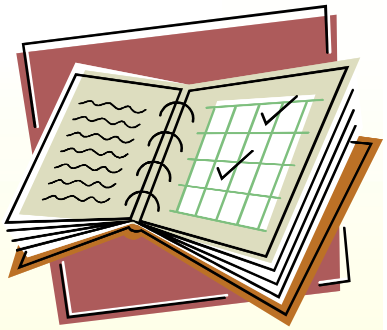
Fix Timelines (Establish)

(3-6 months)

- Create process document templates (e.g., Software Development Plan, Software Requirements Specification.)
- Conduct weekly/monthly status reviews.

(6-9 months)

- Conduct CMMI®-based reviews of the projects.
- Provide feedback regarding project reviews.



(9-12 months)

- Conduct Internal Assessments, with reporting to senior management.
- Provide feedback regarding project review providing requirements for improvement to the projects.

Baseline and Implement Processes (Act)

Use IEEE standards to develop your baseline process documentation.

- Once a process baseline has been established formulate an action plan.
- It is also important to evaluate and identify any potential tools that may be used in support of process automation:
  - A tool is not a substitute for a process.
  - An ideal candidate area for this type of automation is SCM.
  -
- Many IEEE SWE standards provide documentation templates and describe in detail what the processes should contain.

Think of these standards as an *in-house software process consultant* who has recommended, based upon years of experience, the proper methodologies and techniques to be used in support of software development.

Perform Gap Analysis (Learn)

It is important to gauge how effectively process improvements have been implemented for continuous process improvement to be successful.

- Develop a benchmarking appraisal to support gap analysis activities.
- Provides a baseline for future process improvement efforts and will identify weaknesses and strengths.
- Review the associated appraisal methodology used in support of the CMMI®
  - ARC
  - SCAMPI

Looking at the Specifics..

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CMMI-SW Cross-Reference

Level 2 CMMI-SW KPA	IEEE Standards
Requirements Management	IEEE Std 830 – 1998 IEEE Recommended Practice for Software Requirements Specifications
Project Planning	IEEE Std 1058 – 1998 IEEE Standard for Software Project Management Plans
Project Monitoring and Control	IEEE Std 1058 – 1998 IEEE Standard for Software Project Management Plans
Process and Product Quality Assurance	IEEE Std 730 – 2002 IEEE Standard for Software Quality Assurance
Configuration Management	IEEE Std 828 – 1998 IEEE Standard for Software Configuration Management Plans
Supplier Agreement Management	IEEE Std 1062 – 1998 IEEE Recommended Practice for Software Acquisition
Measurement and Analysis	IEEE Std 1045 – 2002 IEEE Standard for Software Productivity Metrics

1st - Framework Definition

- Software Life Cycle
  - **IEEE/EIA 12207.0**, *Industry Implementation of International Standard ISO/IEC12207:1995 —Standard for Information Technology —Software life cycle processes*
    - **IEEE/EIA 12207.1**, *Industry Implementation of International Standard ISO/IEC12207:1995 — (ISO/IEC 12207) Standard for Information Technology —Software life cycle processes – Life Cycle Data*
    - **IEEE/EIA 12207.2**, *Industry Implementation of International Standard ISO/IEC12207:1995 — (ISO/IEC 12207) Standard for Information Technology —Software life cycle processes – Implementation considerations*

- Systems Life Cycle
  - **ISO/IEC 15288**, *Systems engineering — System life cycle processes*

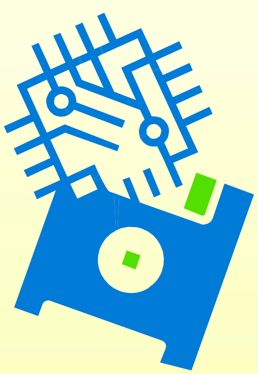
www.computer.org/Standards

PA - Requirements Management

IEEE Std 830-1998, IEEE Recommended Practice for Software Requirements Specifications.

Outlines the requirements for what comprises a good Software Requirements Specification (SRS):

- Establishes the basis for agreement between the customers and the suppliers on what the software product is to do.
- Reduces the development effort.
- Provides a basis for estimating costs and schedules.
- Provides a baseline for validation and verification.
- Facilitates transfer.
- Serves as a basis for enhancement.



Does not directly address Requirements Traceability!

PA - Project Planning

IEEE Std 1058, IEEE Standard for Software Project Management Plans.

- Specifies a suggested format for a project management plan:
  - This document may be used as a guide for documenting the practices and procedures unique to each organization for all types of software efforts.
  - The IEEE Standard for Project Management Plans can be used as a model for this CMMI Level 2 process.
- The purpose of CMMI Level 2 Software Project Planning is to establish reasonable plans for performing software engineering and software project management.

PA - Project Monitoring and Control

Simply initially estimating the duration and total cost of a software effort is not sufficient.

- Planning must continue throughout the software development and maintenance process.
- Project monitoring (tracking) and control of the management process encompasses most of the development process.

This includes all activities that project management has to perform to ensure that the project objectives are met and that development proceeds according to the plan.

- Monitor cost, schedule, quality, and potential risk.
- Take corrective action when necessary.

PA - Supplier Agreement Management

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IEEE Recommended Practice for Software Acquisition, IEEE Std 1062- 1998.

- Provides information on the recommended practice for acquiring software:
  - Describes the software acquisition life cycle.
  - Offers support in preparing contract requirements, proposal evaluation, and supplier selection.
  - Provides insight into the management of a software supplier and product acceptance.
  - Offers a series checklists which consist of information designed to help organizations establish their own software acquisition process.

This standard describes a set of quality practices that can be applied during one or more steps of the software acquisition process.

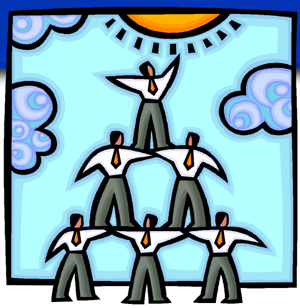
PA – Process and Product Quality Assurance

- The purpose of IEEE Std 730-1998 is to provide uniform, minimum acceptable requirements for the preparation and content of Software Quality Assurance Plans:

- Recommended approaches to good SQA practices are describe in IEEE Std 730.1-1995.

Combined, these two plans describe the requirements in support of industry standard SQA practices.

PA - Configuration Management



SCM as described by IEEE Std 838-1998:

"SCM constitutes good engineering practice for all software projects, whether phased development, rapid prototyping, or ongoing maintenance. It enhances the reliability and quality of software by providing a structure for identifying and controlling documentation, code, interfaces, and databases to support all life cycle phases supporting a chosen development/maintenance methodology that supports the requirements, standards, policies, organization, and management philosophy producing management and product information concerning the status of baselines, change control, tests, releases, audits, etc."

The plan basically provides a framework for organizations to follow. Use of this standard offers a reasonably stable cross-project development environment.

PA - Measurement & Analysis

- **IEEE Std 1044, Standard Classification for Software Anomalies.**
  - Defines a uniform approach to the classification and documentation of the variances found in software products.

- **IEEE Std 1045, Standard for Software Productivity Metrics.**
  - Provides a framework for measuring and reporting software productivity. It is meant for those who want to measure the productivity of the software process in support of their software product.

Through the application of these standards - issues with life cycle processes are identified and improved.

Implementation Summary

Examine each CMMI Level 2 Key Practice (*Co, Ab, Me, Ve,* and *Ac)*.

Identify supporting portions of IEEE standards. Do not consider each standard in isolation, rather consider the ***complete set*** of those most directly supporting CMMI Level 2 items.

Document ***your*** processes using the IEEE standards and Level 2 capabilities.

- *Small projects may require less formality in planning than large projects, but all components of each standard should be addressed by every software project.*
- *Components may be included in the project level documentation, or they may be merged into a system-level or business-level plan, depending upon the complexity of the project.*

Common Implementation Pitfalls

- Being overly prescriptive
- Remaining confined to a specific stage
- Lack of incentives
- No metrics taken
- Documentation for the sake of documentation

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What to watch out for..

Each organization using IEEE standards should develop a set of practices and procedures that provide detailed guidance for preparing and updating plans based upon standards.

- There are some holes relating to PT&O and metrics.
- Pay special attention to CMMI general requirements.
- Funding for process improvement activities is not specifically referenced in IEEE plans, this must be included in the project management plan.
- Need to specifically address requirements traceability throughout product lifecycle.

In Conclusion

- Leverage the expertise contained in the IEEE Software and Systems Engineering Standards.
- Fix timelines to produce goal driven process improvement.
- Define your processes in outline form.
- Perform a gap analysis.
- Redefine your processes.
- Use IEEE standards to develop your baseline process documentation.
- Perform self-audit using CMMI PAs.
- Readjust processes/plans based upon audit results.

Make a plan. Then follow the plan. - Watts Humphrey

Get Involved

IEEE Computer Society:
http://www.computer.org/

IEEE Software Engineering Standards:
http://standards.computer.org/sesc/

IEEE Software Engineering Online:
http://billing.computer.org/portal/index.jsp

CMM/CMMI:
http://www.sei.cmu.edu

To Order IEEE Standards ($320):
http://www.computer.org/cspress/CATALOG/st01121.htp

Need More Help?

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S. Land, J. Walz, *Practical CMMI Software Project Documentation/Using IEEE Software Engineering Standards*, John Wiley/IEEE Press, Oct 2005.

IEEE Software Engineering Standards Collection, Institute of Electrical and Electronics Engineers, Inc. New York, NY, 2003.

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References

CMMI® -SE/SW/IPPD/SS, V1.1, *CMMI for Systems Engineering/Software Engineering/Integrated Product and Process Development, and Supplier Sourcing Version 1.1, CMMI^{SM} -SE/SW/IPPD/SS, V1.1, Continuous Representation.* CMU/SEI-CMU/SEI-2002-TR-011, ESC-TR-2002-011, Carnegie Mellon University, Software Engineering Institute, Pittsburgh, PA, March 2002.

[Croll 2003] Third Annual CMMI® Technology Conference and Users Group, *Eight Steps to Success in CMMI – Compliant Process Engneering,* November 2003.

[Land 2004] 2004 Software and Systems Technology Conference, *The Real World Application of IEEE Software Engineering Standards,* June 2004.

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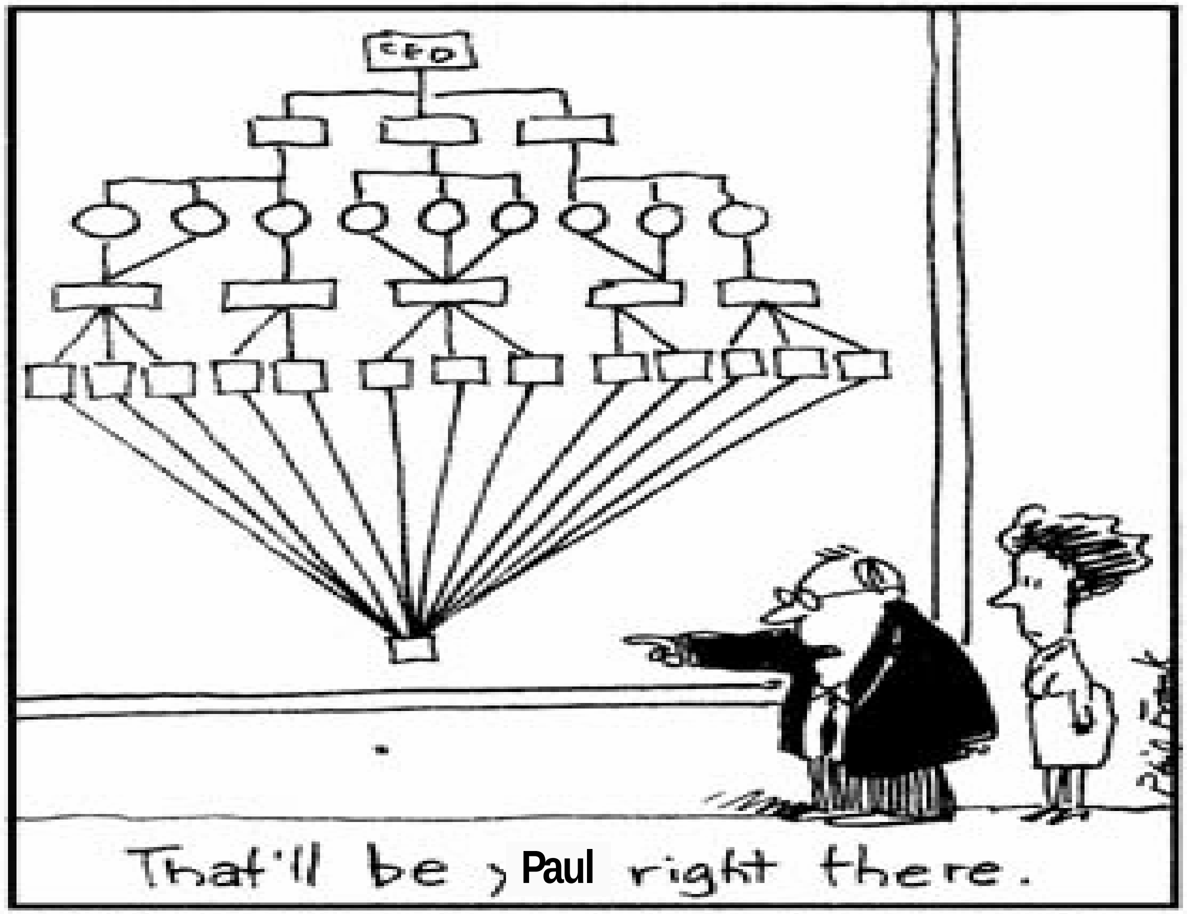
IEEE/EIA Standard 12207.0-1996, *Industry Implementation of International Standard ISO/IEC12207:1995 — (ISO/IEC 12207) Standard for Information Technology —Software life cycle processes*, Institute of Electrical and Electronics Engineers, Inc. New York, NY, 1998.

IEEE/EIA Standard 12207.1-1997, *Industry Implementation of International Standard ISO/IEC12207:1995 — (ISO/IEC 12207) Standard for Information Technology —Software life cycle processes – Life cycle data*, Institute of Electrical and Electronics Engineers, Inc. New York, NY, 1998.

Implementing Process Improvement



Does Size Matter or Was Yoda Right?

Yoda

With the Force size matters not, do or do not, there is no try!

The Question

Does the size of the organization change any of the fundamentals associated with the implementation of CMMI?

Agenda

- The Fundamentals
- Application to Large Organizations (>= 500) and Medium Organizations (100-500)
- Application to Small Organizations (1-100)
- Conclusions

Fundamentals

- Which of these are drivers?
  - Need to Change
  - Costs
  - Competitive requirement
  - CEO/CIO attended seminar where CMMI was mentioned

Fundamentals

ANSWER:

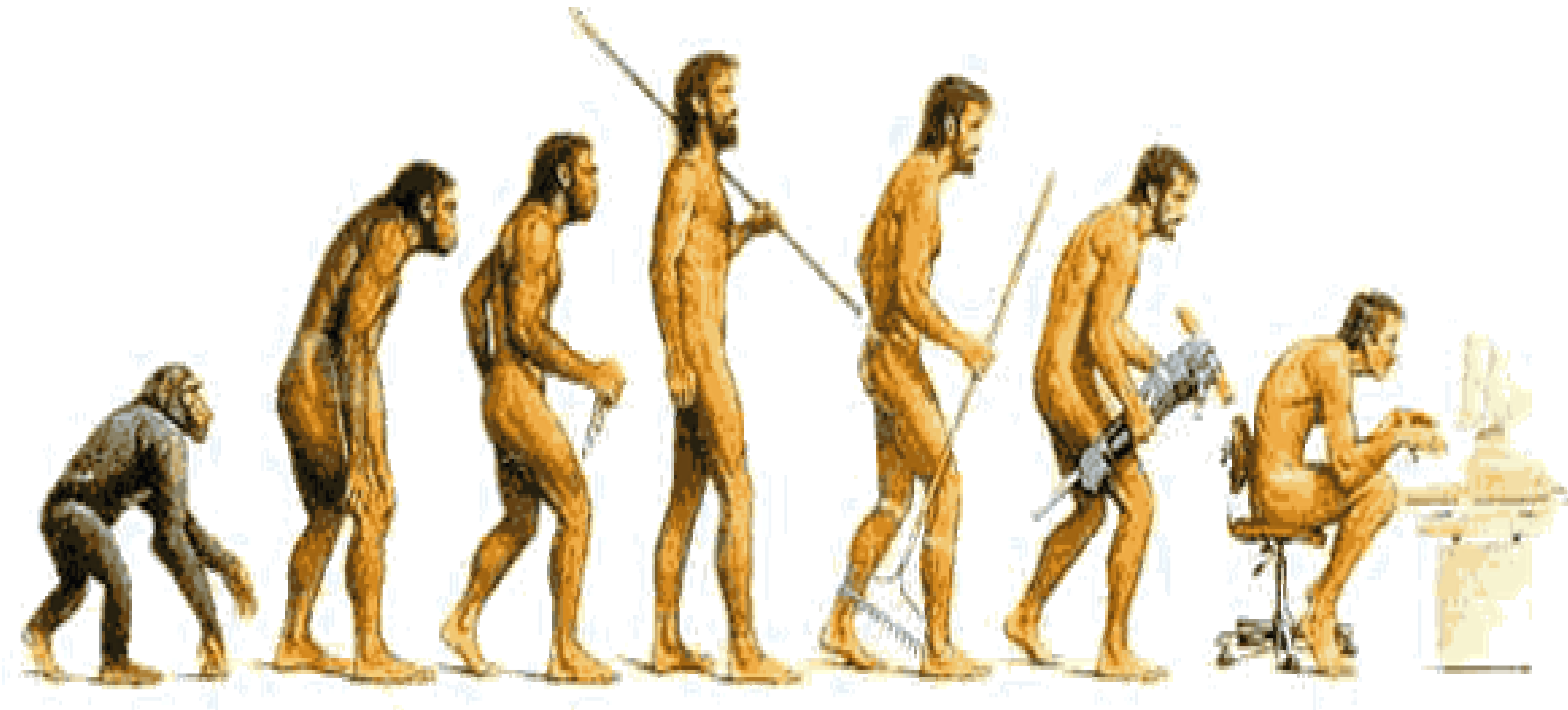
ALL ARE

Fundamental - Change

It is not necessary to change.
Survival is not mandatory.

W. Edwards Deming (1900-1993)

Fundamental - Change



Fundamental - Change

- Less than 30% of those companies that were in the Fortune 500 in 1980 remain in the Fortune 500 today.
- Their success became their failure because they didn’t see the need to change…to adapt to a new world order...until it was too late.
- There is no “status quo.” That is an illusion. You are either getting better faster than the competition, or you are getting worse faster.

Fundamental - Expense*

- 175,000 IT projects are attempted annually at a cost of more than $250 billion
- Over 31% of all projects are canceled at a cost of $81 billion
- Over 50% of all projects exceed their original estimates by almost 100%
- Rework is 40% or more of the cost of software development projects

Source: The Standish Group CHAOS Report

* Projects Only/Does not include Maintenance or Enhancement efforts

Fundamental - Requirement

- Federal Contracts
- State Contracts
- Local Contracts
- Banking
- Pharmaceuticals
- Automotive

Fundamental – CEO/CIO

Without management support, you are finished before you start

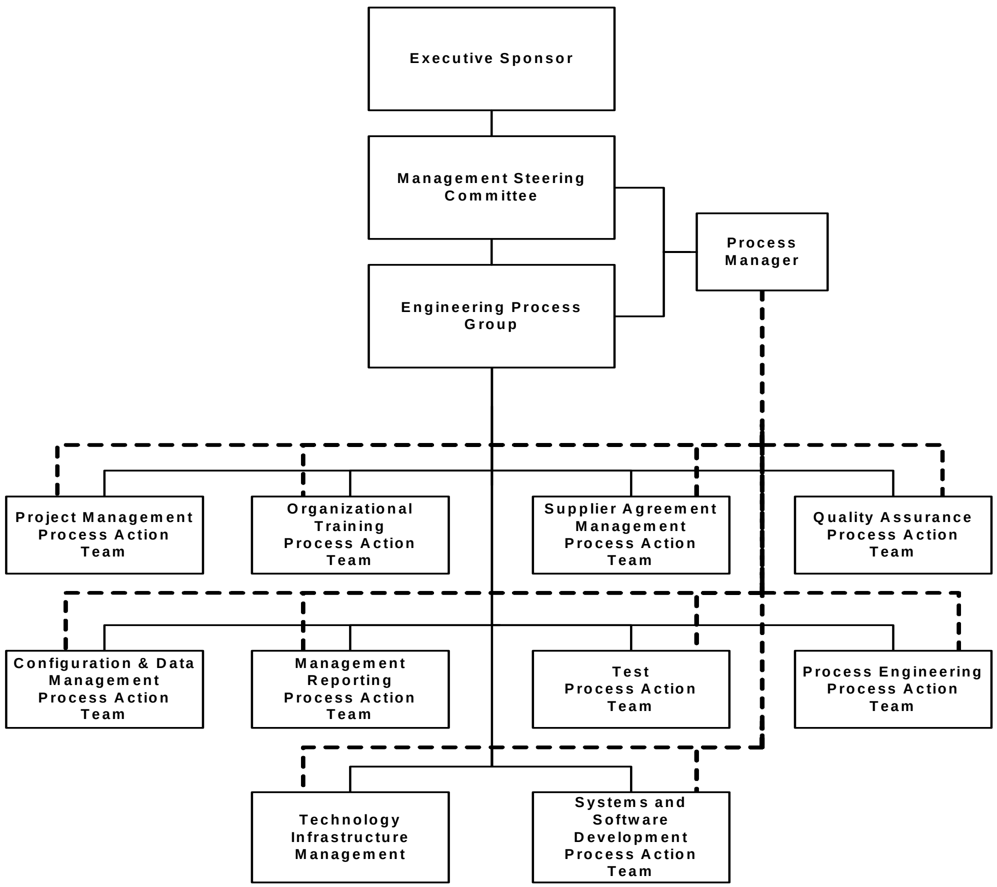
Fundamentals

- Infrastructure of successful Process Improvement efforts:
  - Masochistic Target of Opportunity (MTO), AKA "The Process Person",
  - Sponsor – preferably one with authority and spine
  - Money – training, reference materials, newsletter, trinkets, etc.
    - Hint – quality IS NOT free

Fundamentals

- Infrastructure of successful Process Improvement efforts:
  - Plan – how to “Git er don”
  - Acolytes and Test Subjects – MTO’s in training and pilot projects
    - Without Acolytes you are finished after you start
  - Incentives – two approaches
    - Beatings will continue until moral improves
    - Reward system for achievement that covers more than the CIO

Fundamentals - Infrastructure



Fundamentals - Infrastructure

- Management Steering Committee
  - Provides executive leadership, support, and guidance
- Engineering Process Group– Composed of process area leads and senior managers
  - Provides operational direction, supervision and leadership, technical guidance, and process stewardship
- Process Action Teams – Composed of Process Leads and Process Team Members
  - Accomplish process development, mentoring, and deployment

Large/Medium Organizations (>=500) & (100-500)

- In general, anyone NOT seen these fundamentals apply?
  - Single division/business units
  - Corporate across multiple divisions/business units
  - Projects within divisions/business units
  - Departments within divisions/business units

Small Organizations (1-100)

- Do these fundamentals apply?
  - Change –
    - 90% of small business fail – one trick pony?
    - For a small team in a large/medium organization – single focus or general (robotics/development) – technology drive
  - Costs
    - Small business – cash is king (see failure stat)
    - Small team – can you say “overseas or outsourced”

Small Organizations (1-100)

- Do these fundamentals apply?
  - Competitive requirement –
    - Small business - SBA programs and set-asides
    - Small team – Other teams want you, consolidation
  - CEO/CIO Support
    - Small business – much closer to the problems, but less latitude to solve them
    - Small team – don't have CEO/CIO but managers are expected to think like them

Small Organizations (1-100)

- Do these fundamentals apply?
  - MTO
    - Small business, Small team – who’s responsible
  - Sponsor
    - Small business, Small team – both need buy-in
  - Money – nuff said

Small Organizations (1-100)

- Do these fundamentals apply?
  - Plan
    - Small business, Small team – try without one
  - Acolytes and Test Subjects
    - Small business, Small team – need buy-in from doers
  - Incentives
    - Small business, Small team – only time that “keep your job” may actually be single reason

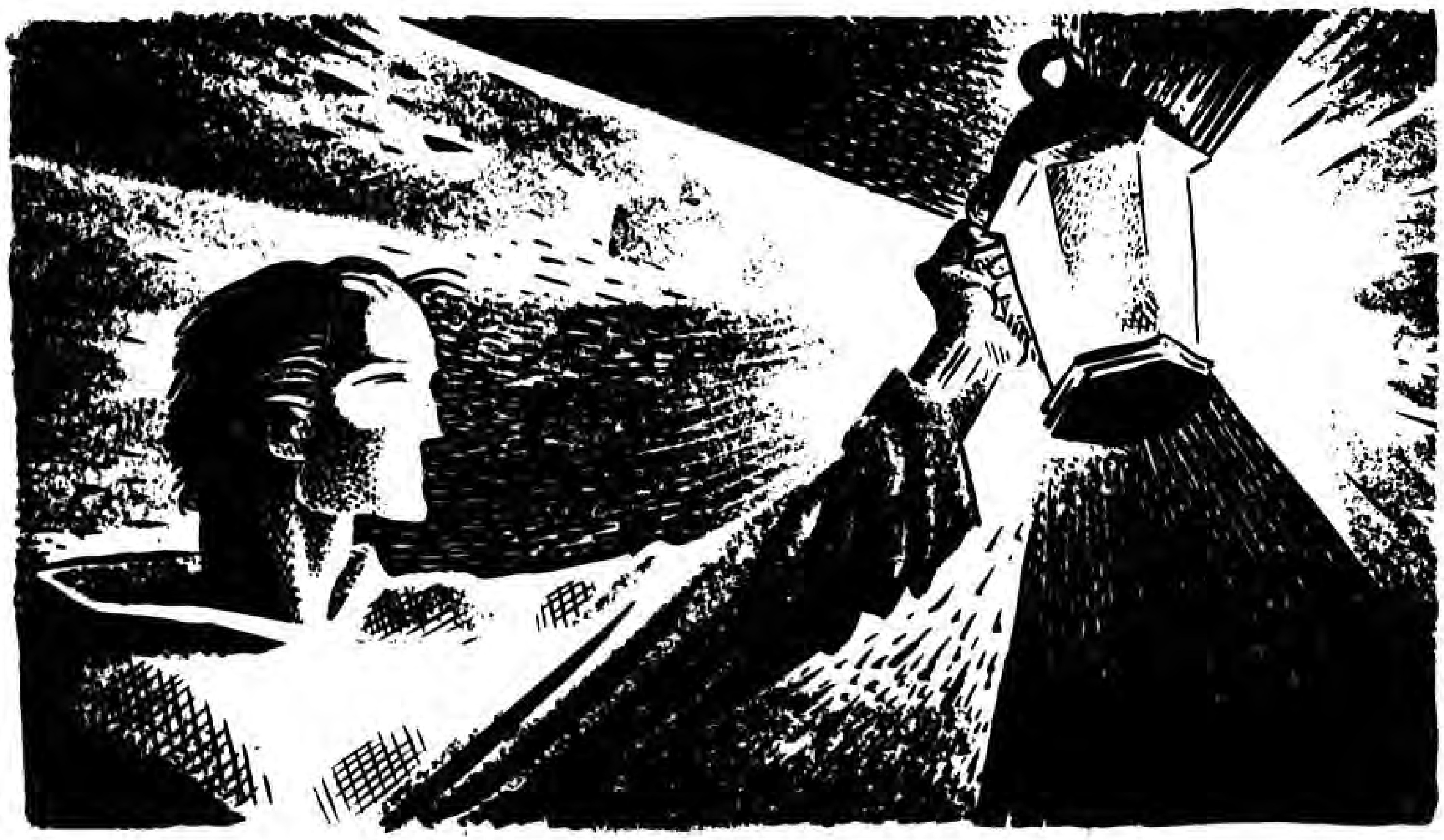
Conclusion

- Understanding that Scope of Work and Level of Effort to accomplish the work are not the same as Fundamental principles that apply to the work - Size does not matter!
  - Build an overpass, build the Golden Gate Bridge

Counter Opinions?

- Speak now or I will assume you are:
  - In agreement
  - Assimilated
  - Numbed by information overload
  - Don’t care – its Reception time

Process Improvement should be the light at the end of the tunnel, not a train coming at you



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Carnegie Mellon
Software Engineering Institute

Building a Credible SCAMPI Appraisal Representative Sample

Bob Moore, Business Transformation Institute, Inc.
Will Hayes, Software Engineering Institute

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What is Design of Experiments?

- Design of Experiments (DOE) is a mathematical statistics technique used to help understand the influence that different experimental factors have on the response from a system.
  - DOE allows us to understand the interaction between factors, as opposed to experimentation that changes just one factor at a time.
  - DOE provides a means for maximizing the information gained from each experiment, thus reducing the number of experiments that we need to conduct.

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DOE in SCAMPI

- DOE has two applications for SCAMPI A, B, and C appraisals:
  1. **Appraisal Planning**: DOE can help to construct an appropriate representative sample of the organizational unit (OU) to be appraised.
  2. **Appraisal Execution**: DOE can help to choose which personnel should be interviewed and which questions should be asked in collecting affirmations.

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DOE and Appraisal Planning

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Why Should We Care About A Good Representative Sample?

- A well-constructed representative sample leads to a superior appraisal return by:
  - Selecting for examination the set of instantiations that provide the greatest potential for verifying process institutionalization per each member of the examined set of instantiations.
    - This provides the most information gained per appraisal resource invested.
    - Other sets of instantiations could be examined, but would be inferior with respect to insights gained on process institutionalization.
  - Enhancing the credibility of the appraisal by providing defensible reasoning that led to the selection of some instances to be included in the appraisal while excluding others:
    - A representative sample that excludes some instantiations without clear reason invites suspicion that the appraisal results may not reflect OU process institutionalization because instantiations detrimental to the OU's case for institutionalization are being avoided.
    - Likewise, a representative sample that insists on including some instantiations without justification might raise questions about the appraisal results again, only this time because instantiations that reflect atypical "good" institutionalization effort are being included.

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How are Representative Samples Constructed Now?

- The SCAMPI Method Description Document does not give us much advice!
  - “Upon determining that sufficient coverage of the reference model and the organizational unit has been obtained, appraisal findings and ratings may be generated.” (SCAMPI MDD, p. I-11.)
  - Coverage is said to imply:
    - “(a) the collection of sufficient data for each model component within the CMMI reference model scope selected by the sponsor, and”
    - “(b) obtaining a representative sample of ongoing processes) spanning the life-cycle phases that the appraised organization is using in the development and delivery of its products and services.”
  - The lead appraiser is further cautioned to construct a “valid sample of the organizational unit to which results will be attributed” based on organization size, scope, and geographic dispersion.
  - The lead appraiser and sponsor are reminded that all statements should be accurate in describing the organization to which results may be attributed.

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Does The MDD's Guidance Work?

- Given this guidance, how is a lead appraiser to construct a "valid sample" that can withstand rigorous, independent examination?
- The current typical practice of using no more than four projects in an appraisal, no matter the size of the appraised organizational unit, may entirely miss information that characterizes how well or poorly the OU is doing with its processes.
- Unfortunately, increasing the number of projects examined doesn't help!
  - Very large samples of projects from a large OU soon become cost prohibitive without providing analytically defensible insight into process performance
  - Although saying "we looked at 10 projects and 10,000 artifacts" sounds impressive—even if it isn't!

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But What Else Can We Do?

- Since a SCAMPI A appraisal is meant to provide a benchmark of an OU’s process performance, we need some technique that:
  - Seeks to maximize information received,
  - Minimizes cost, and
  - Provides appropriate rigor to justify our appraisal planning choices to an independent examiner.
- DOE provides exactly these capabilities!

DOE Language and SCAMPI

- Experiment = an appraisal
- Experimental factors = characteristics of the OU as they are observed across different parts of the organization where work is underway
- Experimental design = the list of instantiations from which we will examine artifacts, based on:
  - The experimental factors present in the OU,
  - The budget available for the appraisal, and
  - The amount of confounding between factors we are willing to accept.
- Response variables = weakness and strengths of process area specific or generic practices and satisfaction of goals.
- Factors effects = the influence that different factors have on the response variables under consideration.
- Confounding = our inability to distinguish between the influence on the response variables of one or more factors with respect to another set of factors. Confounding is undesirable, but may be managed through choice of designs.

DOE Language and SCAMPI, Continued

- Replication = examining more than one instantiation corresponding to a particular set of experimental factors in our chosen design—which provides better insight into institutionalization by having additional instantiations to confirm observed responses.
- Balanced design = a fractional factorial design in which an equal number of trials (at every level state) is conducted for each factor.
- Block & Blocking = When structuring appraisals, blocking may be used to account for some unknown that one wishes to avoid; a block may be a dummy factor that does not interact with the real factors.
- Orthogonal = An appraisal is orthogonal if the effects of any factor balance out (sum to zero) across the effects of the other factors.

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Experimental Resolution

- Experimental resolution helps us to understand the degree of our "known unknowns" in an appraisal.
  - Resolution I = we gain no insight from an appraisal
  - Resolution II = we cannot tell the difference between the influence of main factor effects (why bother?)
  - Resolution III = Main factor effects are confounded (aliased) with two-factor interactions.
  - Resolution IV = No main factor effects are aliased with two-factor interactions, but two-factor interactions are aliased with each other.
  - Resolution V = No main effect or two-factor interaction is aliased with any other main effect or two-factor interaction, but two-factor interactions are aliased with three-factor interactions.

Example OU Experimental Factors

- The factors that influence process institutionalization in an OU depend on that OU. Some typical factors to be considered:
  - The size of the project:
    - Projects that are large or small with respect to the OU's typical project mixture may influence how processes are used.
  - Project age:
    - New or existing projects for the OU may have different understanding or maturity of processes.
  - Project geographic location:
    - Projects performed at a core location or at a remote site may differ in their processes.

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Example OU Experimental Factors, Continued

- Project dispersion:
  - Projects that, within the context of the project, are executed at one location or multiple locations that are inconvenient for daily face-to-face contact may have different processes.
- Project parent organization:
  - The “home” or sponsoring OU for a project may influence how processes are implemented depending on the support of management for the processes.
- Project complexity:
  - Projects that have complex life cycles may have different processes than simpler projects (e.g., spiral versus waterfall life cycle).
- Project customer and users:
  - Projects performed for different customers or users may use different processes depending on the customer or user’s requirements.

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How to Select a Representative Sample for an Appraisal (1)

1. Determine the objectives of the appraisal with respect to the OU scope and process areas to be considered.
2. List the factors that may influence process institutionalization in the OU.
   - Be generous in listing factors—a factor that has no real impact is easily discarded through the application of DOE techniques, but omitting a factor of real influence may skew the appraisal conclusions.
3. Determine if any of the factors are clearly dependent on other factors. If so, these factors may be collapsed into fewer combined factors.
4. Determine the level settings for the factors, such as project size equals one of "large" or "small". Any given factor may have multiple levels, although two levels are easiest from a design and analysis perspective.
5. List all of the instantiations in the OU that are supposed to be using processes corresponding to the process areas under consideration.

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How to Select a Representative Sample for an Appraisal (2)

6. For each instantiation in the list, determine the factor level settings that describe that instantiation.
   - For example, project X may have factor levels of size=large, location=central office, and duration=long, where as project Y may have factor levels of size=small, location=field site, and duration=short.
7. Given the list of factors and their level settings, choose an experimental design.
   - This design will be determined by how much confounding between factors is tolerable and the budget limits on how many different instantiations can be examined in the appraisal.
   - A design catalog or statistical software that supports DOE is indispensable here for exploring the options!
8. Fill in the experimental design from step 7 with actual instantiations using the information in step 6.

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An Example of Selecting A Representative Sample Using DOE

- Suppose we are examining an OU that has five factors to be accounted for in an appraisal:
  - Project size: large or small
  - Project age: new or existing
  - Project geographic location: domestic or international
  - Project customer: government or commercial
  - Project complexity: high or low
- We have 5 factors at 2 levels that might influence process institutionalization in the OU.

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Full Factorial Design

- The full factorial design (all factors at all levels), we would have to examine 32 (2x2x2x2x2) instantiations!
- The design is given on the next page for illustration purposes.
- No one is expected to ever construct such an appraisal.

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	Size	**Age**	**Location**	**Customer**	**Complexity**
Instantiation = 1	L = large	N = new	D = domestic	G = government	H = high
2	L	N	D	G	L = low
3	L	N	D	C = commercial	H
4	L	N	D	C	L
5	L	N	I = international	G	H
6	L	N	I	G	L
7	L	N	I	C	H
8	L	N	I	C	L
9	L	E = existing	D	G	H
10	L	E	D	G	L
11	L	E	D	C	H
12	L	E	D	C	L
13	L	E	I	G	H
14	L	E	I	G	L
15	L	E	I	C	H
16	L	E	I	C	L
17	S = small	N	D	G	H
18	S	N	D	G	L
19	S	N	D	C	H
20	S	N	D	C	L
21	S	N	I	G	H
22	S	N	I	G	L
23	S	N	I	C	H
24	S	N	I	C	L
25	S	E	D	G	H
26	S	E	D	G	L
27	S	E	D	C	H
28	S	E	D	C	L
29	S	E	I	G	H
30	S	E	I	G	L
31	S	E	I	C	H
32	S	E	I	C	L

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Alternatives to Full Factorial

- Except in limited circumstances, a full factorial selection on instantiations is too expense and too time consuming.
  - Note: for this presentation, we are neglecting the idea that an appraisal might want to look at more than one instantiation for each setting of factors (replication). Looking at multiple instantiations for the same factors is a good idea—but the number of instantiations to be examined grows rapidly!
- Besides, who needs complicated math to try every combination of everything?
- DOE offers an alternative: fractional factorial designs.

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A ¼ Fractional Factorial Design

- In the example above, instead of using a full factorial design, we could also have conducted our appraisal using a fractional factorial design of $2^{5-2} = 8$ instantiations.

Number of Levels of Factors

Number of Factors

Fraction

- A ¼ design in this case is a Resolution III experiment.
- The choice of a fractional factorial design will depend on the number of factors to be considered and the acceptable experimental resolution.

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The ¼ Fractional Factorial Design

Instantiation	Size	Age	Location	Customer	Complexity
1	S	E	I	G	H
2	L	E	I	C	L
3	S	N	I	C	H
4	L	N	I	G	L
5	S	E	D	G	L
6	L	E	D	C	H
7	S	N	D	C	L
8	L	N	D	G	H

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Still Too Many Instantiations!

- From the viewpoint of a SCAMPI A appraisal, using 8 instantiations across multiple process areas still seems like a lot!
  - Note: we're still doing better than a traditional representative sample selection method—we at least clearly understand the impact of different factors on our appraisal.
- Going to a 1/8 fractional factorial would give 4 instantiations to be appraised—but drops our resolution down to Resolution II.
- What to do . . . ?

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Using DOE with SCAMPI B and C

- DOE works best not as a single experiment, but as a sequence.
- This is ideally suited to SCAMPI:
  - Conduct early appraisals that examine many factors and instantiations as SCAMPI Cs.
  - Based on the results, eliminate factors (and the need for instantiations).
  - Conduct later appraisals that examine fewer *critical* factors and instantiations as SCAMPI As or Bs.
  - Note: changing lead appraisers from one appraisal to another allows you to block your design according to lead appraiser—if lead appraisers are unbiased!

Example SCAMPI C

- Consider the setup in the example above: 5 factors that may influence the OU's process institutionalization.
- We would like to determine which factors really influence the process and which are not important.
- Eventually, we want to benchmark the OU using a SCAMPI A.
- We will start with a SCAMPI C.
- For illustration purposes, we will only look at the appraisal covering two process areas (PP and REQM) at Capability Level 2.
  - The example could be expanded to as many PAs as we like, but the calculations are lengthy in a presentation.

Assigning Numerical Values to Response Variables

- As defined in the SCAMPI C method, we would usually assign a color (green, yellow, red) as the characterization of each instantiation's specific and generic practices.
- To aid in our analysis, we will assign numerical values against these characterizations:
  - Red = 0
  - Yellow = 0.5
  - Green = 1.0
- The assigned values may be changed, if desired.
- Similar values may be assigned for characterizations using in other SCAMPIs. For example:
  - NI = 0
  - PI = 0.5
  - LI = 0.75
  - FI = 1

Aggregation at the Goal Level

- To aid in our analysis, we are going to take the arithmetic mean of the specific practices and generic practices at the goal level for each instantiation.
- For REQM (similarly for PP),

$$\text{Score(SG 1)} = \frac{Score(SP1.1-1) + Score(SP1.2-2) + Score(SP1.3-1) + Score(SP1.4-2) + Score(SP1.5-1)}{5}$$

$$\text{Score(GG 2)} = \frac{Score(GP2.1) + Score(GP2.2) + \cdots + Score(GP2.10)}{10}$$

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Characterization Data from the SCAMPI C

- We perform the SCAMPI C appraisal using the instantiations given above.
- The results:

	S	A	L	C	C	PP SG 1	PP SG 2	PP SG 3	PP GG 2	REQM SG 1	REQM GG 2
Instantiation = 1	S	E	I	G	H	0.38	0.71	0.83	0.75	0.60	0.75
2	L	E	I	C	L	0.25	0.86	0.83	0.75	0.60	0.75
3	S	N	I	C	H	0.88	0.93	1.00	0.95	0.80	0.95
4	L	N	I	G	L	0.88	0.86	1.00	0.95	0.90	0.95
5	S	E	D	G	L	0.13	0.14	0.17	0.20	0.10	0.20
6	L	E	D	C	H	0.25	0.14	0.17	0.20	0.10	0.25
7	S	N	D	C	L	0.50	0.43	0.50	0.40	0.40	0.45
8	L	N	D	G	H	0.50	0.43	0.50	0.50	0.30	0.45

Analysis of Data

- In a simple analysis, we account for the impact of any particular factor (e.g., instantiation size or age) by:
  - Adding the responses for the goal when a given factor is set "high";
  - Subtracting the responses for the goal when the same factor is set "low"; and,
  - Dividing the result by the number of high (or low) settings (i.e., 4 in this case.)
- Let R(x) equal the response value for instantiation x.
- For example, the impact of age on PP, SG 2 (across all instantiations) is:

¼ *[Sum(Responses when Age = "Existing") – Sum(Responses when Age = "New")] =

¼ * [R(2)+R(4)+R(6)+R(8)-R(1)-R(3)-R(5)-R(7)] = 0.017857

Full Data Results

	PP SG 1	PP SG 2	PP SG 3	PP GG 2	REQM SG 1	REQM GG 2
Effect of size	0.00	0.02	0.00	0.03	0.00	0.01
Effect of age	0.20	0.20	0.25	0.23	0.25	0.21
Effect of location	-0.58	-0.55	-0.58	-0.53	-0.50	-0.51
Effect of customer	0.00	-0.05	0.00	0.03	0.00	-0.01
Effect of complexity	0.01	-0.02	0.00	0.03	-0.05	0.01

- Our conclusion is that instantiation location and age have an impact on process institutionalization.
- All other factors appear to have negligible impact.

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Next Steps

- The analysis given here is very elementary.
  - More sophisticated analysis techniques may be found at http://www.itl.nist.gov/div898/handbook/ and its references.
  - Additional designs, appropriate for many more situations, may be found at the same location.
- Given the analysis, our next appraisal might be a SCAMPI B that examines only two factors: location and age.
  - A design using only two factors is full factorial with $2^2 = 4$ instantiations.
  - We may wish to conduct the next appraisal with replication against some of the design elements, to provide more insight into institutionalization.

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What Have We Learned?

- DOE provides a technique to help us choose appraisal representative samples in a more rigorous manner.
- DOE fits with conducting a sequence of SCAMPI appraisals, leading to a benchmark SCAMPI A.
- DOE techniques may be applied in a SCAMPI context with similar schedule duration to traditional SCAMPIs.
- DOE can be a complex subject, but there are many software packages and online and print references to make applying it easier.

What Haven't We Discussed

- DOE techniques actually work better for planning SCAMPIs for large OUs because there are more instantiations available for any given design.
- Instantiations that reflect some factor settings may not be available in all OUs—we haven't covered how to handle this situation.

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DOE and Interview Questions

The Interview Dilemma

- Conducting interviews in an appraisal gives much the same challenge as choosing a representative sample.
  - There are many questions to ask and many people to whom we wish to ask them.
- How do we choose?
- **Note**: If we have information needs, then we will want to ask particular people specific questions!
- DOE is useful for general questions intended to fulfill face-to-face affirmation coverage requirements.

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Example: Designs for Interviews

- We can categorize personnel as “managers”, “engineers”, and various kinds of “support”.
- Each person will also have an instantiation (possibly more than one) associated with them.
- In this case, the personnel categories and the personnel’s binned instantiation provide the settings for the factors.
- We choose the questions to be asked of each person based an experimental design guiding us to sample certain combinations of personnel categories and instantiations.
- Due to SCAMPI coverage requirements, particularly for SCAMPI As, we will need a fractional factorial constrained design.
  - Unlike the regular fractional factorial, constrained designs are not conveniently available for reference.
  - Our only choice in this case is to use software that supports DOE.

Example: Interview Design

- Note: this is an example to demonstrate how the technique might be applied, not a real design.
  - The ideas are the same as applied in choosing a representative sample, so we will not repeat the details!
- Suppose we have personnel categories "manager" and "engineer".
- Suppose we have two instantiations to consider: project 1 and project 2.

Business
Transformation
Institute

The Design

	Question 1	Question 2	Question 3	Question 4
Manager, Project 1	Ask	No	No	Ask
Manager, Project 2	No	Ask	Ask	No
Engineer, Project 1	No	Ask	Ask	No
Engineer, Project 2	Ask	No	No	Ask

Summary

- DOE provides a powerful method for designing reasonable representative samples.
  - DOE is of greatest benefit in dealing with large OUs with many factors and instantiations.
  - DOE works well in screening out instantiations that do not provide much “new” information through SCAMPI Cs and Bs.
- DOE provides a means during an appraisal for determining the general questions to ask various personnel types on different projects.
  - Specific questions to answer information are still directed as usual.

Contact Information

- Bob Moore, Business Transformation Institute, Inc.
  - rlmoore@biztransform.net
- Will Hayes, Software Engineering Insitute
  - wh@sei.cmu.edu

Top 10 Signs You're Ready (or Not) For an Appraisal

Gary Natwick

Harris Corporation

Government Communications Systems Division

HARRIS

- $1.8B in Sales
- 8,000 Employees
- ISO 9001:2000
- CMMI® Level 3
- SW-CMM® Level 4

DoD Programs

Civil Programs

National Programs

Strategic Management and Business Development

Homeland Security Programs

Harris Technical Services Corporation

Background

- Increasing requirement for organizations to demonstrate compliance to CMMI®
  - Formal appraisals (SCAMPI℠ A)
  - Progress appraisals (SCAMPI℠ B&C)
- Appraisal preparation:
  - Time consuming & labor intensive
  - Success depends on getting it right the first (and sometimes only) time
- Risk of achieving an organization's process maturity goal can be minimized through:
  - Appraisal experiences, both positive and negative
  - Industry benchmarking

Sign You're Ready (or Not) - #10

- Organization has Process Leadership
  - Senior Management Commitment
  - Dedicated Resources
    - Process Group
    - Budget
    - Tools
  - Process Model selection
    - CMMI®-SE/SW/IPPD/SS
    - Staged or Continuous representation
  - Monitor and enforce Process Compliance
    - All Qualifying projects
    - All Functional Organizations

Improvement Organization

Division Process Council

- President, GCSD Staff
- Steering Committee for integrated, division-wide process improvement
- Representatives from each functional organization

Division Process Group

- Working Arm of the DPC
- Empowered representatives from each functional organization
- Owns and maintains (CCB) division-level process command media (Integrated Process Manual)
- Monitors and enforces process compliance

Program Mgmt Exec Council	Eng Proc Council	Bus Ops Council	Sub contracts Council	Contracts Council	Material Mgmt Council	Mfg/I&T Council	BD Council	Security Council	Quality Council	Human Resources

CMMI®-SE/SW Staged Representation

HARRIS

Maturity Level	Focus	Process Areas
5 Optimizing	*Continuous Process Improvement*	Organizational Innovation and Deployment Causal Analysis and Resolution
4 Quantitatively Managed	*Quantitative Management*	Organizational Process Performance Quantitative Project Management
3 Defined	*Process Standardization*	Requirements Development Technical Solution Product Integration Verification Validation Organizational Process Focus Organizational Process Definition Organizational Training Integrated Project Management Risk Management Decision Analysis and Resolution
2 Managed	*Basic Project Management*	Requirements Management Project Planning Project Monitoring and Control Supplier Agreement Management Measurement and Analysis Process and Product Quality Assurance Configuration Management
1 Initial		

Sign You're Ready (or Not) - #9

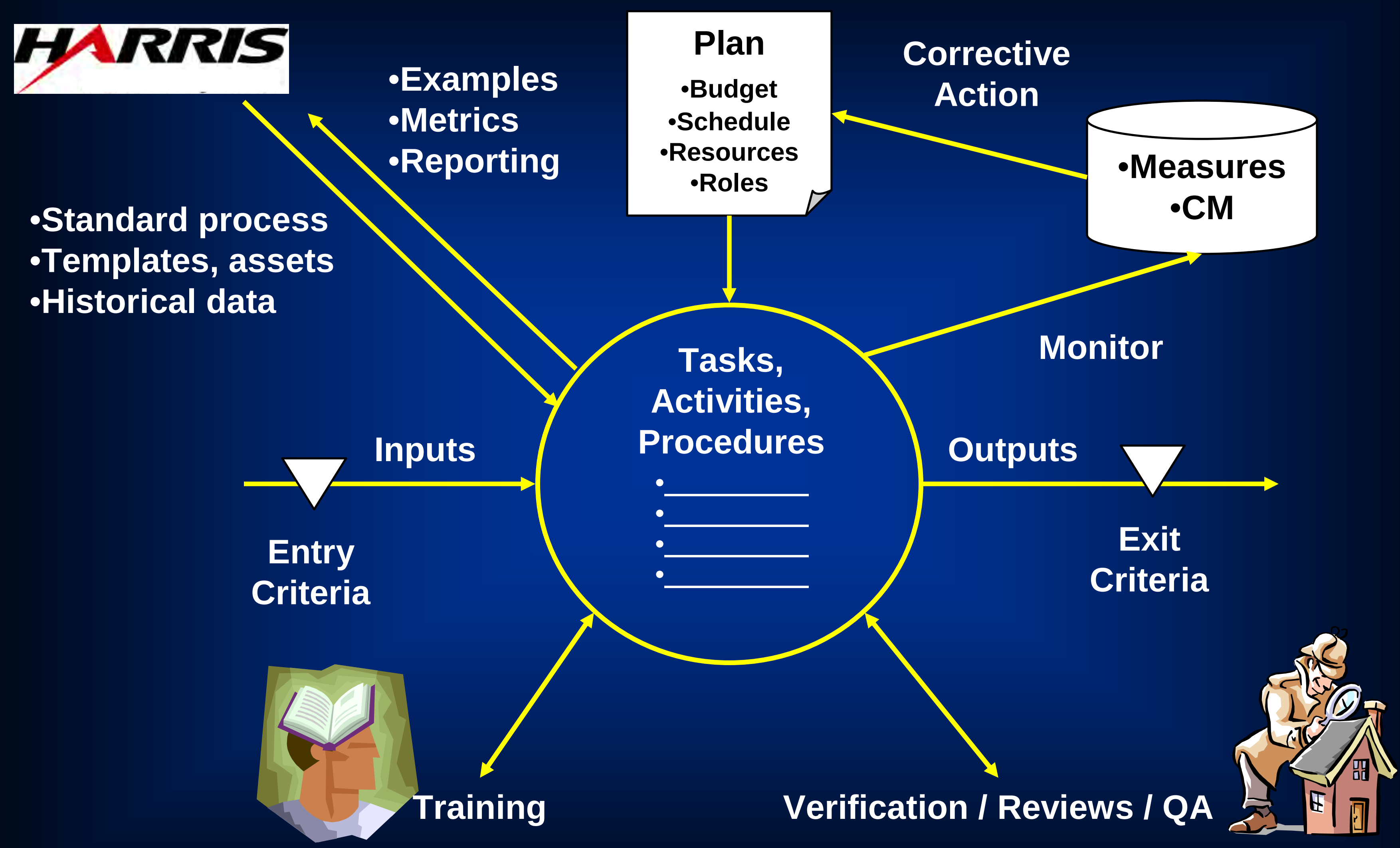
- Organization has a Process Improvement Plan
  - Scope
    - Establish how implemented in organization & projects
    - Internal users (projects, managers, process group)
    - External users (customers, appraisal teams)
  - Process Improvement Organization
  - Process Improvement Objectives
    - Strategic
    - Tactical
    - Measurement
  - Appraisals
    - Primary source of candidate process improvements

Sign You're Ready (or Not) - #8

HARRIS

- Organization has Integrated Processes
  - Organizational requirements
    - Process Model compliance (CMMI®)
  - Integration and collaboration across functional organizations
  - Disciplined repeatable processes with objective criteria
    - Entry/exit criteria, inputs, outputs, verification, measures
  - Planning each process, and tracking against plan
    - Tailoring standard processes and assets
  - Budgets, schedules, resources
  - Managing established baselines
  - Managing Stakeholder involvement
  - Measuring progress and improvement

What is a Process?



Integrated Process Criteria

HARRIS

Overview
A brief description of the process intent

Entry Criteria
State, Prerequisites, Criteria

Exit Criteria
State, Prerequisites, Criteria

Inputs
Required work products

Outputs
Resulting work products

Required Activities
Mandatory tasks to implement the process

Measures
Process performance against plans

Organizational Improvement Information
Metrics, reusable work products

Verification
Process compliance oversight

Tailoring
Approved tailoring, process specific

Implementation Guidance
Common implementation descriptions

Supporting Documentation and Assets
Applicable GCSD references.

CMMI® Process Area Categories

HARRIS

CMMI®

Project Management

- Project Planning
- Project Monitoring and Control
- Supplier Agreement Management
- Integrated Project Management
- Risk Management
- Quantitative Project Management

Engineering

- Requirements Management
- Requirements Development
- Technical Solution
- Product Integration
- Verification
- Validation

Support

- Configuration Management
- Process and Product Quality Assurance
- Measurement and Analysis
- Decision Analysis and Resolution
- Causal Analysis and Resolution

Process Management

- Organizational Process Focus
- Organizational Process Definition
- Organizational Training
- Organizational Process Performance
- Organizational Innovation and Deployment

- Maturity Level 2
- Maturity Level 3
- Maturity Level 4
- Maturity Level 5

Integrated Process Manual

HARRIS

IPM

Program Management Processes

- Program Planning
- Estimation
- Program Monitoring and Control
- Supplier Acquisition & Management
- Change Management

Program Life-Cycle Processes

- Proposal Development
- Requirements Analysis
- System Architecting/Design
- Design
- Code and Unit Test
- Fabrication and Assembly
- Product Integration
- Verification
- Validation
- Production
- Field Support

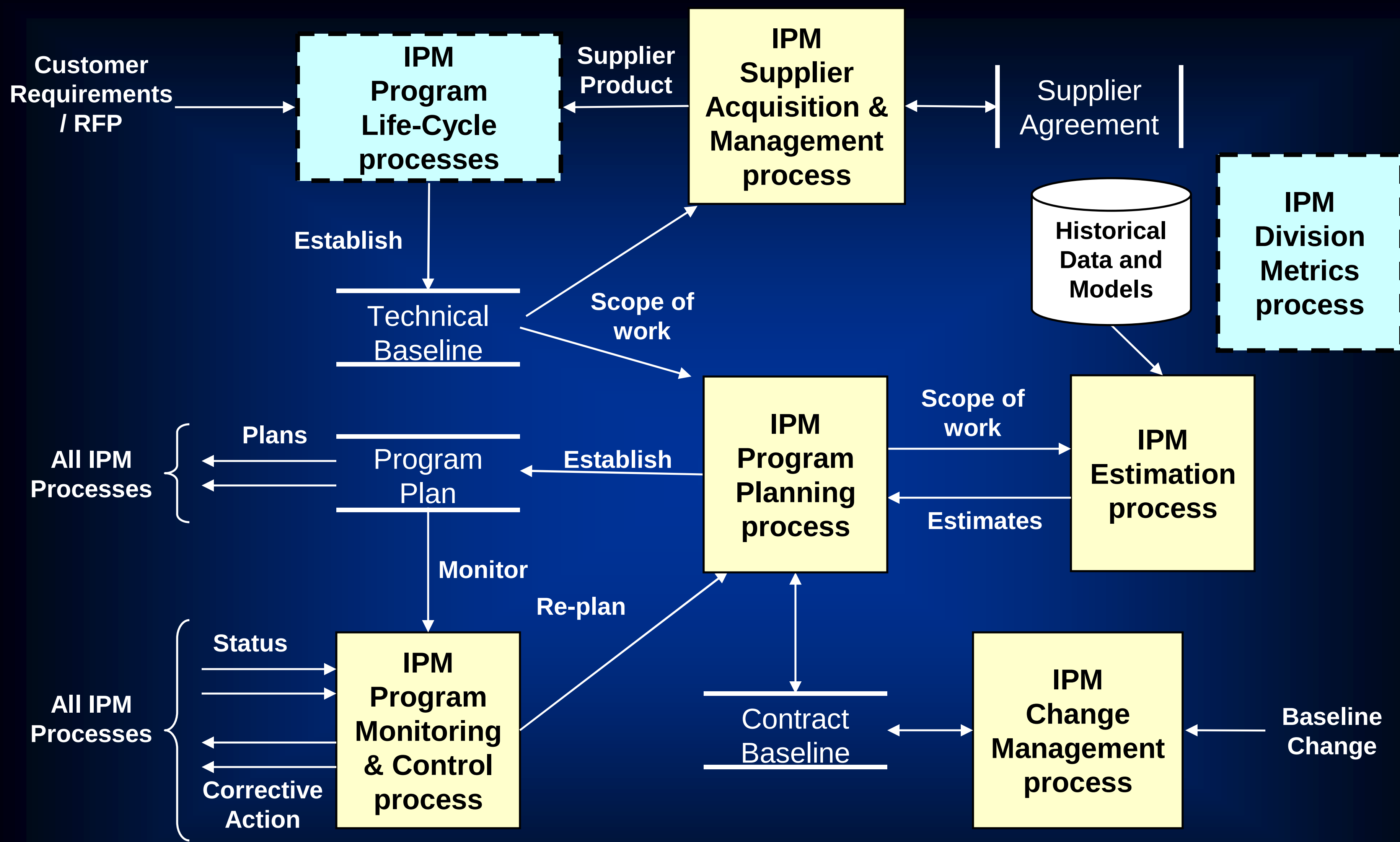
Program Support Processes

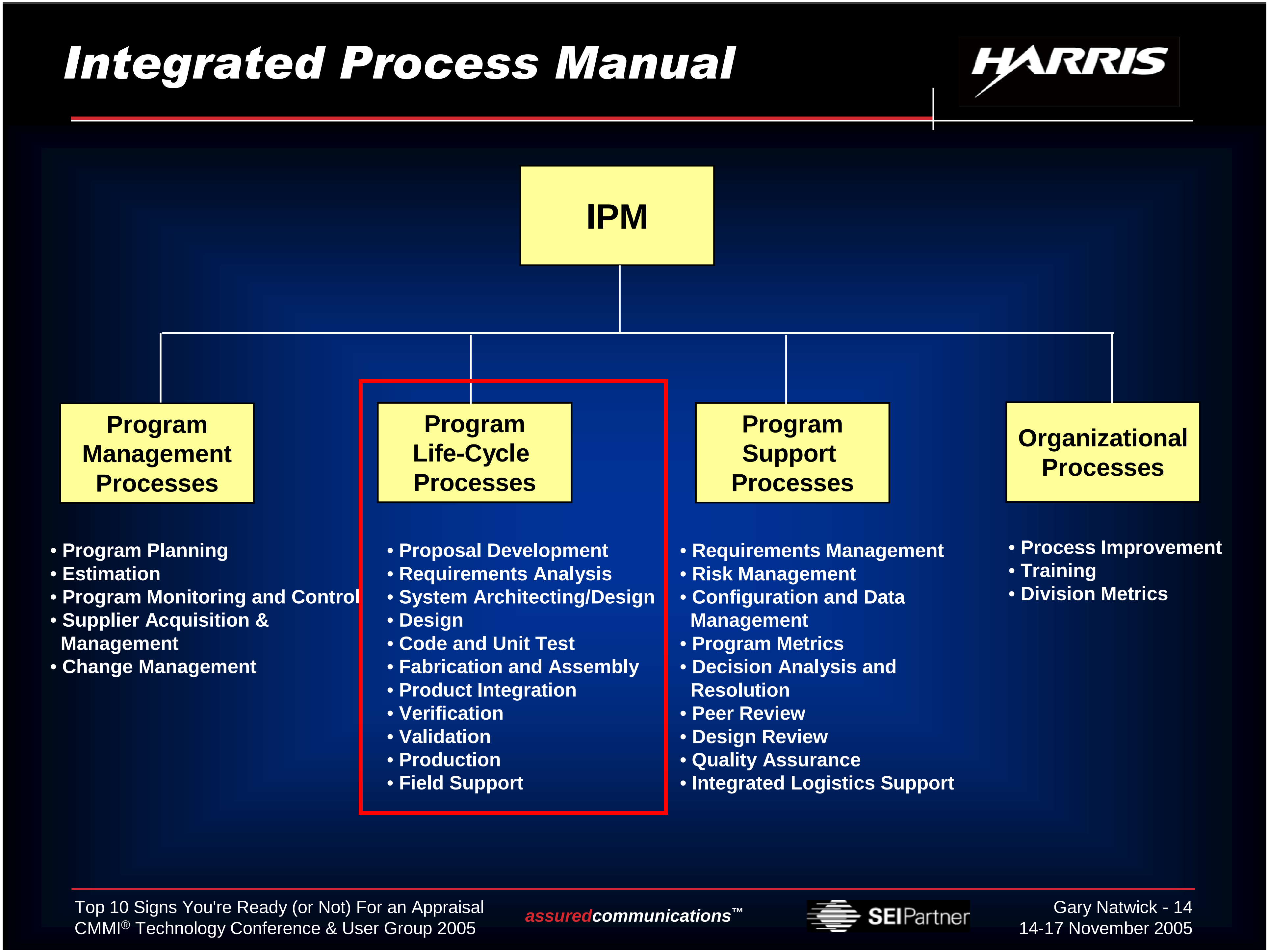
- Requirements Management
- Risk Management
- Configuration and Data Management
- Program Metrics
- Decision Analysis and Resolution
- Peer Review
- Design Review
- Quality Assurance
- Integrated Logistics Support

Organizational Processes

- Process Improvement
- Training
- Division Metrics

Program Management Processes




Integrated Process Manual
HARRIS
IPM
Program Management Processes
• Program Planning
• Estimation
• Program Monitoring and Control
• Supplier Acquisition & Management
• Change Management
Program Life-Cycle Processes
• Proposal Development
• Requirements Analysis
• System Architecting/Design
• Design
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Organizational Processes
• Process Improvement
• Training
• Division Metrics
Top 10 Signs You're Ready (or Not) For an Appraisal
CMMI® Technology Conference & User Group 2005
assuredcommunications™
SEIPartner
Gary Natwick - 14
14-17 November 2005

Program Life-Cycle Processes - 1

HARRIS

IPM Proposal Development process	IPM Requirements Analysis process	IPM System Architecting/ Design process	IPM Design process	IPM Fab/Assembly process IPM Code and Unit Test process	IPM Product Integration process
IPM Verification Process					
IPM Validation Process					

Program Startup Review

Life-Cycle Phase	Business Acquisition	System Requirements	System Design	Prelim Design Detail Design	Fab, Code,	Integration	Verification
Baseline	Proposal Baseline	Requirements Baseline	Functional Baseline	•Allocated •Design	Developmental Configuration		Product Baseline
Milestones / Reviews	TBR PCR	SRR	SDR	PDR CDR		TRR	System Test PCA, FCA
Key Products	Proposal Prog Plans (P) Sys Arch (P)	Prog Plans Requirements CONOPS Operational Threads / Use Cases	Sys Arch Sys Design Interface Defn Technical Data Package Traceability	Prelim Design Detail Design Design docs Test cases / descriptions Traceability	Assembled Components Component test procs / results	Integration plan (F) Integration procedures Integration results	Test procedures Test results Traceability Delivered systems

Program Life-Cycle Processes - 2

HARRIS

	IPM Production process	IPM Field Support process
	IPM Verification process	
	IPM Validation process	
	Other IPM Program Life-Cycle processes (as applicable)	
Life-Cycle Phase	Production	Field Support
Baseline	Product Baseline	Product Baseline
Milestones / Reviews	Production Readiness Review	
Key Products	Production plan Delivered systems As-built documents Test results	Site Transition / Install Plan Revisions to product baseline Test results

- IPM Production and Field Support processes apply only to the extent required by contract
  - May be not applicable
  - May implement revisions to the baseline products
  - May involve other life cycle processes
    - Requirements, design, implementation
- IPM Production Process
  - Produce and deliver multiple systems
- IPM Field Support Process
  - Site installation
  - Operations support
  - Engineering services

Integrated Process Manual

HARRIS

IPM

Program Management Processes

- Program Planning
- Estimation
- Program Monitoring and Control
- Supplier Acquisition & Management
- Change Management

Program Life-Cycle Processes

- Proposal Development
- Requirements Analysis
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- Design
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- Fabrication and Assembly
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- Field Support

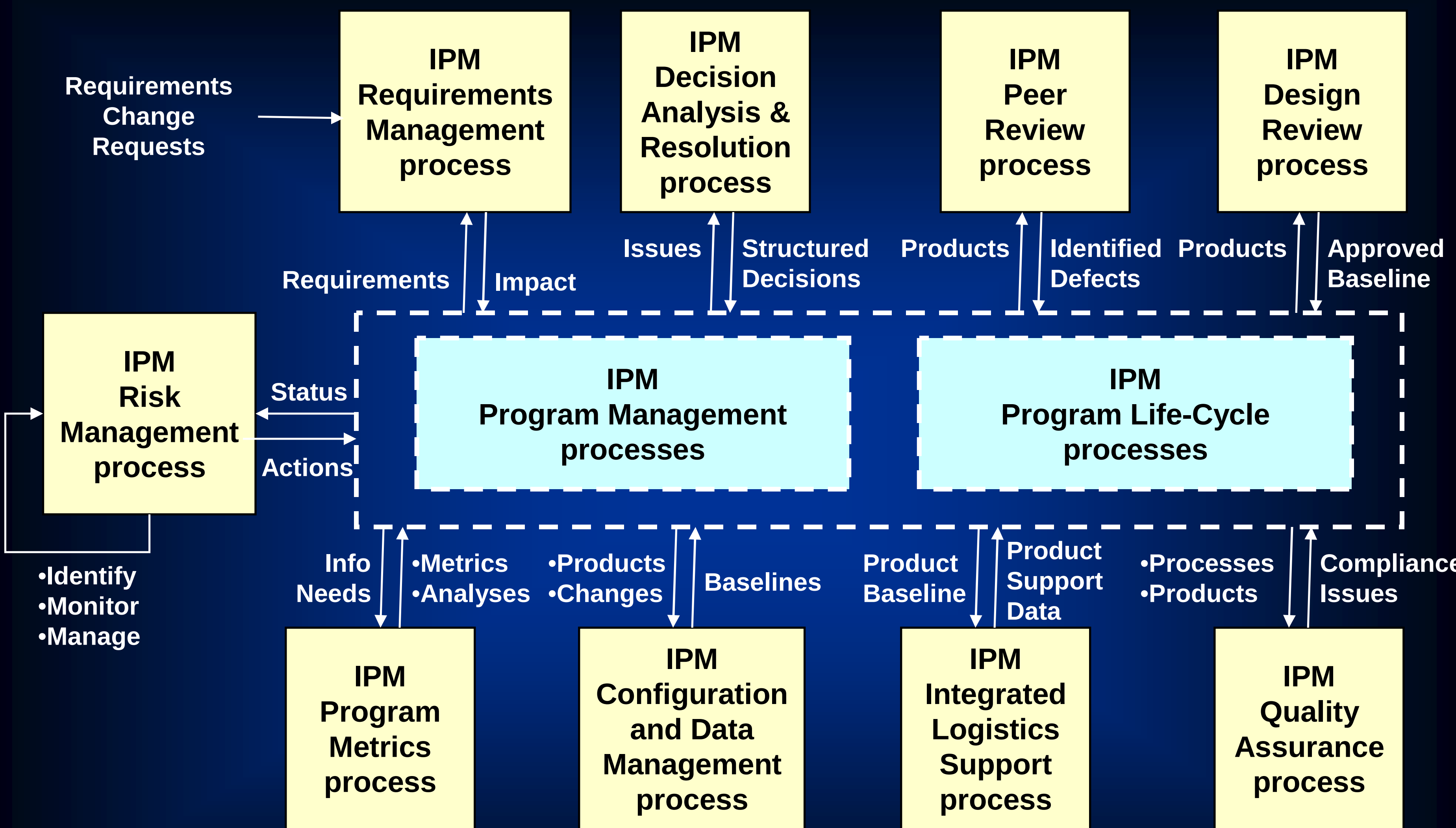
Program Support Processes

- Requirements Management
- Risk Management
- Configuration and Data Management
- Program Metrics
- Decision Analysis and Resolution
- Peer Review
- Design Review
- Quality Assurance
- Integrated Logistics Support

Organizational Processes

- Process Improvement
- Training
- Division Metrics

Program Support Processes



Integrated Process Manual

HARRIS

IPM

Program Management Processes

- Program Planning
- Estimation
- Program Monitoring and Control
- Supplier Acquisition & Management
- Change Management

Program Life-Cycle Processes

- Proposal Development
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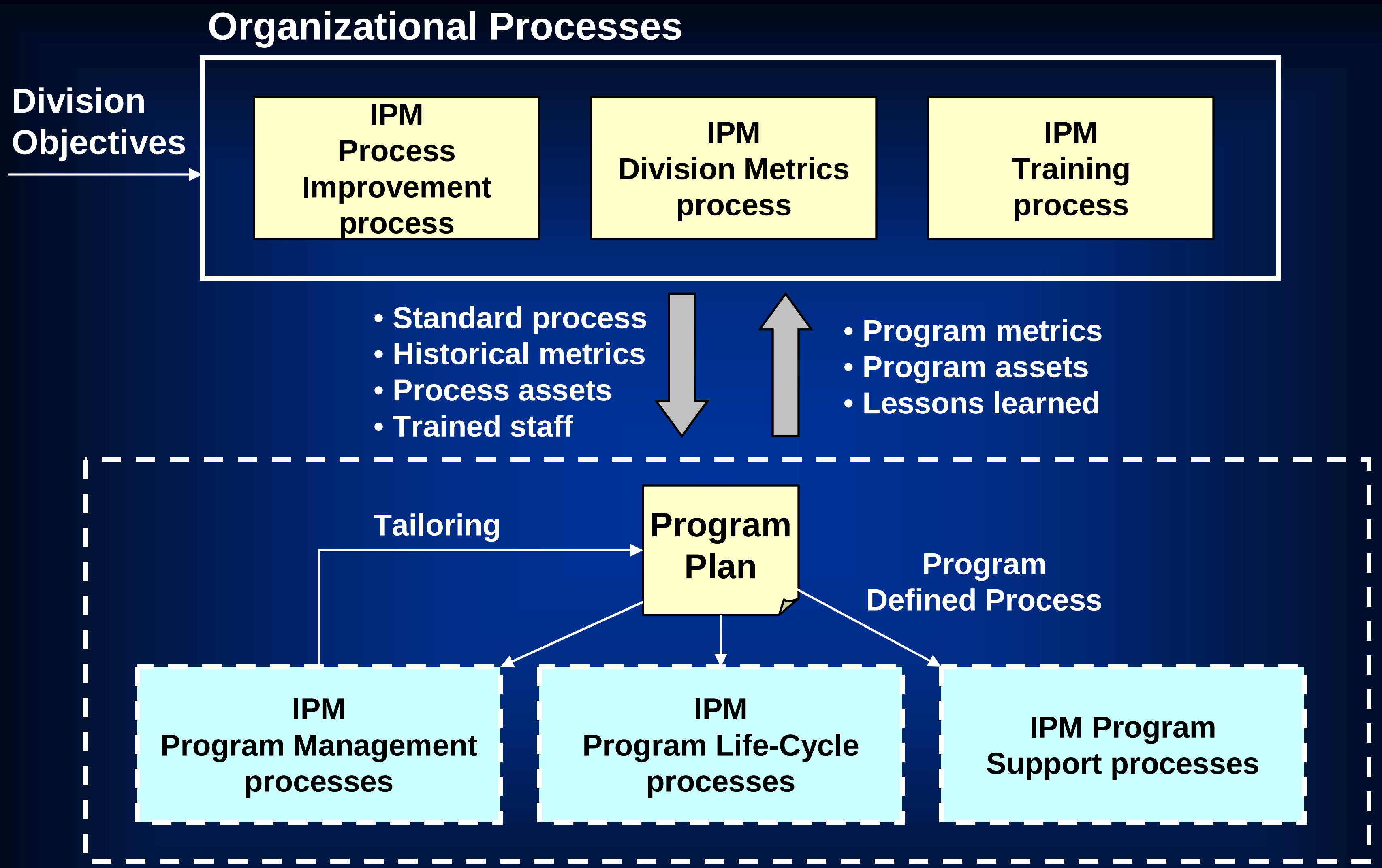
Organizational Processes

- Process Improvement
- Training
- Division Metrics

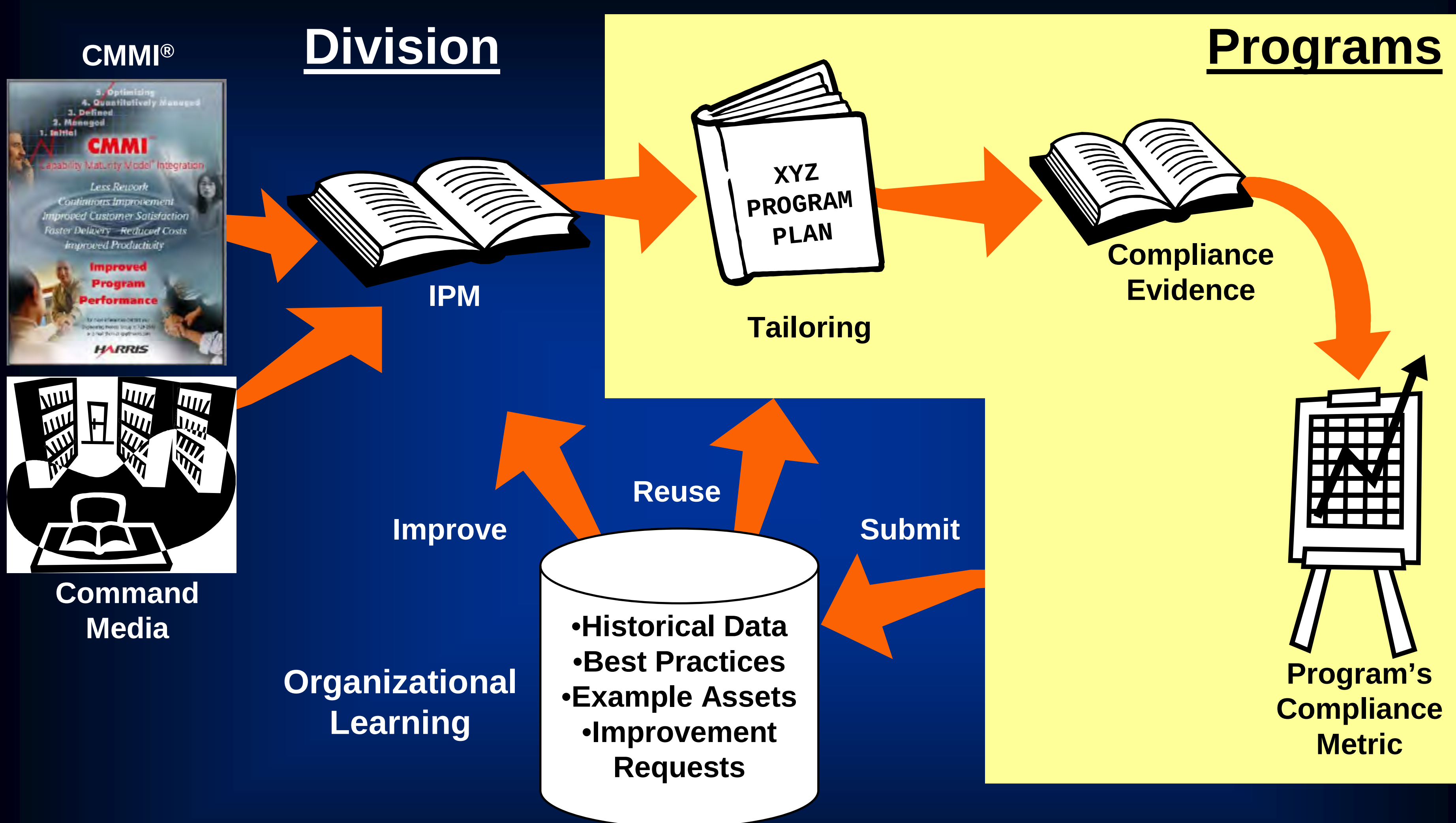
Organizational Processes



Sign You're Ready (or Not) - #7

- Process Compliance is Audited & Monitored

Integrated Compliance Approach



Tailored Processes

- Program's process is tailored from "defined process"

A	Accept IPM statement as written (no changes)
T	Tailored; description of tailoring must be specified (e.g., modifications meeting intent of IPM statement)
D	Deviation; program alternative to IPM statement(s), or not implemented; Waiver Approval required
N	Not applicable; specify rationale

- Approved by Division Management
- Establishes the approved baseline against which process compliance audits are performed
- Functional plans (SEMP, SDP, etc.) are reviewed and approved by cognizant functional manager

Program Process Evidence

HARRIS

Overview
A brief description of the process intent

Entry Criteria State, Prerequisites, Criteria	**Exit Criteria** State, Criteria
Inputs Needed work products, resources	**Outputs** Resulting work products

Required Activities
Mandatory tasks to implement the process

Measures
Process performance against plans

Organizational Improvement Information
Metrics, reusable work products

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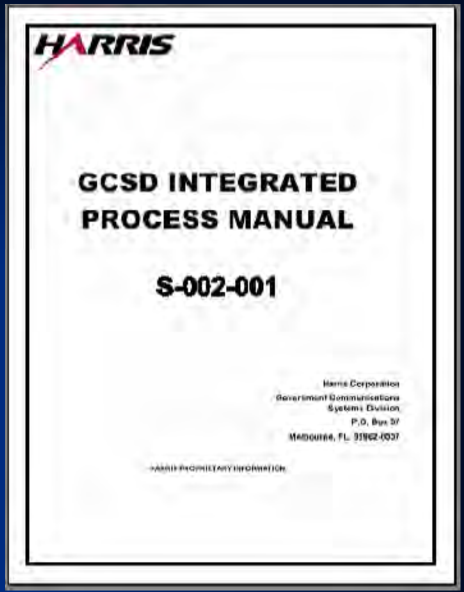
Process compliance oversight

Tailoring
Approved tailoring, process specific

Implementation Guidance
Common implementation descriptions

Supporting Documentation and Assets
Applicable organizational references



Program evidence needed to demonstrate IPM process compliance

Process Compliance

HARRIS

Integrated Process Manual

Tailoring

1. Program Plans
2. Program process baseline
3. Program execution
4. Compliance evidence
5. QA verification
6. Non-compliance mitigation

Program Start-up

Program Phase Execution

Program Appraisals

Process Compliance Monitor (PCM)

PCM Project Workflow

HARRIS

Project request to DPG

Startup & Planning

Create Project → Close/Open Project → Add/Modify Project Users

Process Baseline → Create New Process Baseline → Tailor New Process Baseline → Submit New Process Baseline → Approve/Reject New Process Baseline

Execution

Process Evidence → Add/Modify Process Evidence

Process Appraisal → Create Process Appraisal → Release New Process Baseline → Score Process Appraisal → Close Process Appraisal

Process Monitoring → Monitor Process Compliance

Process Compliance Scores

HARRIS

ASSESSMENT STATUS COLORS / PROCESS COMPLIANCE COLORS	Code	Score	Description
ASSESSMENT STATUS COLORS	NY	**Not Yet**	• To be appraised at a later date (i.e., the process has not yet been executed by the process and cannot be appraised)
	NA	**Not Applicable**	• Not applicable to the project (e.g., Code and Unit Test Process is not applicable to a production-type program)
	NS	**Not Scored**	• Pending an appraisal
PROCESS COMPLIANCE COLORS	FI	**Fully Implemented**	• Direct artifacts are present and appropriate • No substantial weaknesses
	LI	**Largely Implemented**	• Direct artifacts are present and appropriate • One or more substantial weaknesses
	PI	**Partially Implemented**	• Direct artifact is absent or inadequate • Substantiated by indirect artifact/affirmation • One or more substantial weaknesses
	NI	**Not Implemented**	• Any situation not covered by the above

Sign You're Ready (or Not) - #6

- Appraisal Plan is Approved
  - Purpose
  - Key Appraisal Participant Information
  - Appraisal Scope
  - Process Context Information
  - Key Appraisal Parameters
  - Planned Tailoring
  - Appraisal Outputs
  - Appraisal Constraints
  - Activities, Resources and Schedule
  - Milestones & Schedule
  - Risk Management
  - Affirmations

Sign You're Ready (or Not) - #5

HARRIS

- Artifacts are Managed
  - Plan
  - Tools
    - Configuration control
    - Appraisal with active links
  - Artifact stability
    - Broken links
    - Moving data
    - Aging data
    - Version control
  - Baselines
  - Backups

Sign You're Ready (or Not) - #4

- Artifacts have Descriptions and Locations
  - Organizational/project terminology and definitions
  - Explicit practice and/or artifact descriptions
  - Explicit artifact titles
  - Artifact locations
    - Online hyperlinks
    - Explicit for quick reference
    - Directories/folders for institutionalization
  - Explicit Process Model tags
    - CMMI practice mapping
    - Direct, indirect, and affirmation tagging

Process Compliance Evidence

HARRIS

- *Direct Artifacts*
  - *Tangible outputs resulting directly from implementation of a practice*
    - *e.g., plans, documents, products*

Required for:
- ***every applicable IPM practice***
- ***every applicable project***

- *Indirect Artifacts*
  - *Artifacts that are a side-effect or indicative of performing a practice*
    - *e.g., meeting minutes, reviews, logs, reports, metrics*
- *Affirmations*
  - *Oral or written statements confirming or supporting implementation of the practice*
    - *e.g, interviews, questionnaires*

• Optional for IPM compliance (expected, but not required).

•In formal CMMI® appraisals (e.g., SCAMPI℠), these are required to corroborate direct artifacts.

Sign You're Ready (or Not) - #3

- Evidence exists across Project Life Cycle
  - All project phases intersect with one or more organizational processes
  - Direct and indirect or affirmation for each occurrence

Evidence Collection across the Project Life Cycle

Program Phases									
IPM Processes	Business Acquisition	System Rqmts	System Design	Preliminary Design	Detailed Design	Fabrication, Code and Integration	Verification	Production	Field Support
Program Planning	X	X	X	X	X	X	X	X	X
Estimation	X	X	X	X	X	X	X	X	X
Program Monitoring & Control		X	X	X	X	X	X	X	X
Supplier Acquisition Mgmt	X	X	X	X	X	X		X	X
Change Management	X	X	X	X	X	X	X	X	X
Proposal Development	X								
Requirements Analysis	X	X							
System Architecting & Design	X	X	X						
Design	X			X	X				
Code and Unit Test						X			
Fabrication and Assembly						X			
Product Integration						X			
Verification	X	X	X	X	X	X	X	X	X
Validation	X	X	X	X	X	X	X		X
Production								X	
Field Support									X
Requirements Management	X	X	X	X	X	X	X	X	X
Risk Management	X	X	X	X	X	X	X	X	X
Configuration and Data Mgmt	X	X	X	X	X	X	X	X	X
Program Metrics		X	X	X	X	X	X	X	X
Decision & Analysis Resolution	X	X	X	X	X	X	X	X	X
Peer Reviews	X	X	X	X	X	X	X	X	
Design Reviews	X	X	X	X	X				
Quality Assurance	X	X	X	X	X	X	X	X	X
Integrated Logistics Support	X	X	X	X	X	X	X	X	X

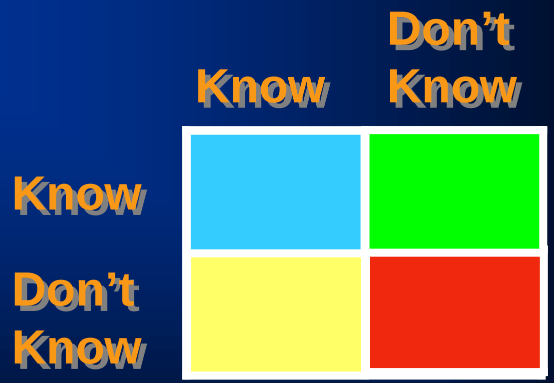
Sign You're Ready (or Not) - #2

HARRIS

- Evidence Themes exist for Process Areas
  - Within each Practice
    - Indirect artifacts compliment direct artifacts
    - Dates and versions are aligned
  - Across practices within each Goal
    - Artifacts form a common purpose
    - Continuity is established
  - Across goals within each Process Area
    - Project institutionalization is understood
  - Across projects with each Process Area
    - Organizational institutionalization is understood

Sign You're Ready (or Not) - #1

- Evidence Readiness Reviews are Completed
  - Pre-appraisal (SCAMPI) Readiness Review
  - Verification (99-100%) vs. Discovery (1-0%)
    - Direct and indirect artifacts for every practice
    - Relevance to practice
    - Evidence Themes exist
  - Independent review is required
    - External appraisers is key
    - Know vs. Don't Know



Top 10 Signs You're Ready (or Not)

HARRIS

1. Evidence Readiness Reviews are Completed
2. Evidence Themes exist for Process Areas
3. Evidence exists across Project Life Cycle
4. Artifacts have Descriptions and Locations
5. Artifacts are Managed
6. Appraisal Plan is Approved
7. Process Compliance is Audited & Monitored
8. Organization has Integrated Processes
9. Organization has a Process Improvement Plan
10. Organization has Process Leadership

Contact Information

Gary Natwick gnatwick@harris.com

- SEI-Authorized CMMI® Instructor
- SEI-Authorized SCAMPI℠ Lead Appraiser
- SEI-Authorized SCAMPI℠ B&C Team Leader
- Harris SEI Partner Business & Technical Point of Contact

Harris Corporation http://www.harris.com/
P.O. Box 37
Melbourne, Florida 32902-0037

Licensed by the Software Engineering Institute (SEI) to provide:

- SEI Introduction to CMMI® courses
- SEI SCAMPI℠ Appraisal Services

NATIONAL DEFENSE INDUSTRIAL ASSOCIATION
STRENGTH THROUGH INDUSTRY & TECHNOLOGY

Welcome

to the

5th Annual
CMMI Technology Conference
and
User Group

Sponsored by

National Defense Industrial Association
Systems Engineering Division

With Technical CoSponsorship By

Software Engineering Institute,
Carnegie Mellon University

NATIONAL DEFENSE INDUSTRIAL ASSOCIATION
STRENGTH THROUGH INDUSTRY & TECHNOLOGY

Program - Tuesday Nov 15

8:30 AM- 12:00 noon PLENARY SESSION **Grand Mesa D-E-F**

8:45 AM - 9:30 AM: Opening Keynote

LTG Joseph Yakovac, USA, Military Deputy, Assistant Secretary of the Army, Acquisition, Technology & Logistics

9:30 AM - 10:00 AM COFFEE BREAK **Atrium**

10:00 AM - 12:00 n: Executive Panel: **Grand Mesa D-E-F**
How has CMMI Improved Program/Project Performance - -or has it???
Moderator: Mr Mark Schaeffer, OUSD(AT&L) Principal Deputy, Defense Systems and Director, Systems Engineering (also OSD Sponsor of CMMI)
Mr. Dev Banerjee, Division Director, Systems & Flight Engineering, Boeing Integrated Defense Systems

Mr. John Evers, Raytheon Processes Program Manager, Raytheon Common Engineering Process Program

Dr. Arthur Pyster, Senior VP and Director of Systems Engineering & Integration, SAIC Federal Systems

Brig Gen Gary Salisbury, USAF (Ret.), Vice President & Executive Director, Busioness Development, Defense Mission Systems, Northrop Grumman Corp.

NATIONAL DEFENSE INDUSTRIAL ASSOCIATION
STRENGTH THROUGH INDUSTRY & TECHNOLOGY

Luncheon Speakers

Tuesday **Grand Mesa A/B/C**

Mr. Clyde Chittister, Chief Operating Officer, Software Engineering Institute, and Bob Rassa, Raytheon, Industry Chair, CMMI Steering Group and Industry sponsor of CMMI

CMMI – The State of the Model

Wednesday **Grand Mesa A/B/C**

Awards Luncheon for Best Paper Awards

Awards for Best Papers per Track, and Best Overall Paper, will be presented by Jeff Dutton, Jacobs-Sverdrup Corp

Awards are sponsored by Jacobs Sverdrup Corp

Thursday **Grand Mesa A/B/C**

no speaker

Conference ends at 3:00 PM after final sessions

NATIONAL DEFENSE INDUSTRIAL ASSOCIATION
STRENGTH THROUGH INDUSTRY & TECHNOLOGY

Program - Tuesday Nov 15

1:30 PM-3:00 PM

1 CMMI and Process Improvement	**Grand Mesa D/E**
2 Practical Guidance	**Grand Mesa F**
3 CMMI Appraisals	**Highlands**
4 ROI & Benefits of CMMI	**Chasm Creek**
5 Acquisition	**Mesa Verde**
6 Transitioning to CMMI	**Wind River**
7 CMMI for Small Projects & Organizations	**Wind Star**
3:00 PM - 3:30 PM COFFEE BREAK	**Atrium**

3:30 PM-5:30 PM

All above tracks continue…….Track 5 now High Maturity

5:00 - 6:30 PM

RECEPTION in Displays Area	**Atrium**

Program - Wednesday Nov 16

8:00 AM- 9:30 AM

1 CMMI and Process Improvement	Grand Mesa D/E
2 Practical Guidance	Grand Mesa F
3 CMMI Appraisals	Highlands
4 ROI & Benefits of CMMI	Chasm Creek
5 High Maturity	Mesa Verde
6 Transitioning to CMMI	Wind River
7 Measurement	Wind Star
9:30 AM - 10:30 AM COFFEE BREAK	Atrium

10:30 AM-12:00 Noon

All above tracks continue……..

Program - Wednesday Nov 16

1:30 PM - 3:00 PM

1 CMMI and Process Improvement	Grand Mesa D-E
2 Practical Guidance	Grand Mesa F
3 CMMI Appraisals	Highlands
4 ROI & Benefits of CMMI	Chasm Creek
5 High Maturity	Mesa Verde
6 CMMI Extensions	Wind River
7 Measurement	Wind Star
3:00 PM - 3:30 PM COFFEE BREAK	Atrium

3:30 PM - 5:30 PM

All above tracks continue……..

Program - Thursday Nov 17

NATIONAL DEFENSE INDUSTRIAL ASSOCIATION
STRENGTH THROUGH INDUSTRY & TECHNOLOGY

8:00 AM- 9:45 AM

1 CMMI and Process Improvement	**Grand Mesa D/E**
2 Practical Guidance	**Grand Mesa F**
3 CMMI Appraisals	**Highlands**
4 ROI & Benefits of CMMI	**Chasm Creek**
5 High Maturity	**Mesa Verde**
6 CMMI Extensions	**Wind River**
7 Systems Engineering	**Wind Star**
9:30 AM - 10:30 AM COFFEE BREAK	**Atrium**

10:15 AM-12:00 Noon

All above continue………….

NATIONAL DEFENSE INDUSTRIAL ASSOCIATION
STRENGTH THROUGH INDUSTRY & TECHNOLOGY

Program - Thursday Nov 17

1:00 PM- 3:00 PM

1 CMMI and Process Improvement	Grand Mesa D/E
2 Practical Guidance	Grand Mesa F
3 CMMI Appraisals	Highlands
4 SCAMPI B & C Appraisals	Chasm Creek
5 High Maturity	Mesa Verde
6 CMMI Extensions	Wind River
7 Systems Engineering	Wind Star

Some Logistics Info---

Message Number: (303) 779-1234 (and ask for NDIA desk)

Displays & Coffee Breaks are in Atrium.

Lunches (Tues, Wed, Thursday) are in Grand Mesa A/B/C at 12:00 noon

Birds of a Feather (BOF) Meetings are posted on the Message Board near the registration Area

STRENGTH THROUGH INDUSTRY & TECHNOLOGY

Special Thanks To---

Technical Program Chairs:

Brian Gallagher, Software Engineering Institute
Randy Walters, Northrop Grumman

Session & Track Chairs: **Paul Croll, CSC; Hal Wilson, Northrop Grumman; Brian Gallagher, SEI; Dennis Goldenson, SEI; Geoff Draper, Harris Corp; Randy Walters, Northrop Grumman; Jeff Dutton, Jacobs- Sverdrup; Rich Turner, OSD; Jerry Fisher, Aerospace Corp; Diane Gibson, SEI.**

Tutorial Instructors: **Tim Kasse, Kasse Initiatives LLC; Jeff Dutton, Jacobs Sverdrup; Rolf Rietzig, Cognicence; Rick Hefner, Northrop Grumman; Tim Olson, Quality Improvement Consultants; David Raffo, Portland State Univ; Donald Borcherding, NexSummit LLC; Mike Phillips, SEI; William Diebler, Software Systems Quality Consulting;**

NDIA Staff: Emily Brown and Veronica Allen

And finally---

Proceedings

CD-ROM distributed at registration, contains all presentations submitted by deadline

Conference Feedback Survey

Fill out Survey Form (available at registration desk) and give to Emily Brown or Veronica Allen

We always strive to improve, so we would like your feedback

CMMI Technology Conference, Nov 2006

Call for Papers & Displays available at registration desk

Implementing a Plan for Controlling Program ROI for CMMI ® Process Improvement

J.Perry, Z.Dennis, D.Halley, P.Lenzen, S.Madison, D.Sims

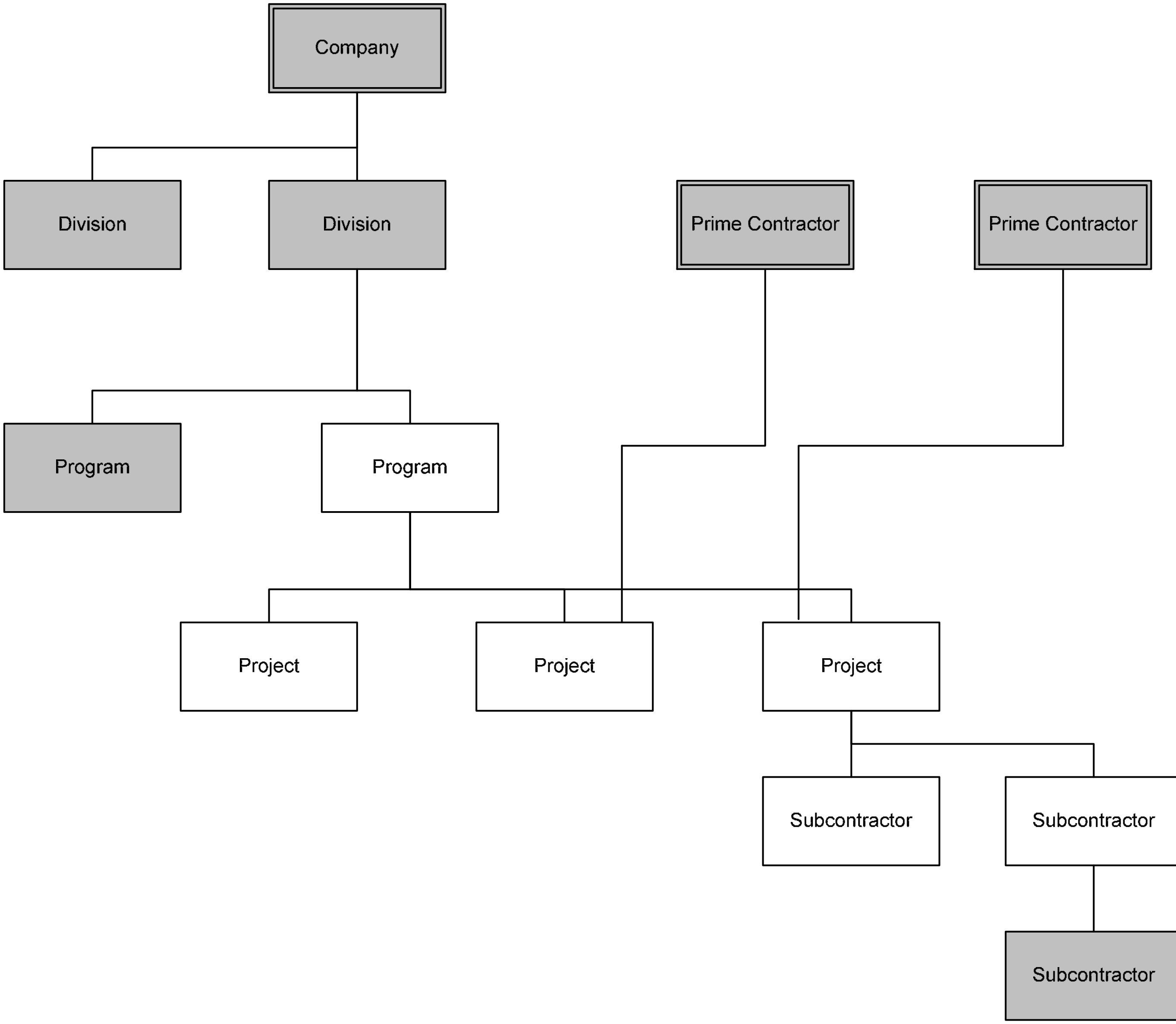
james.m.perry@baesystems.com

Objectives

Use ‘ROI’ as a measure for

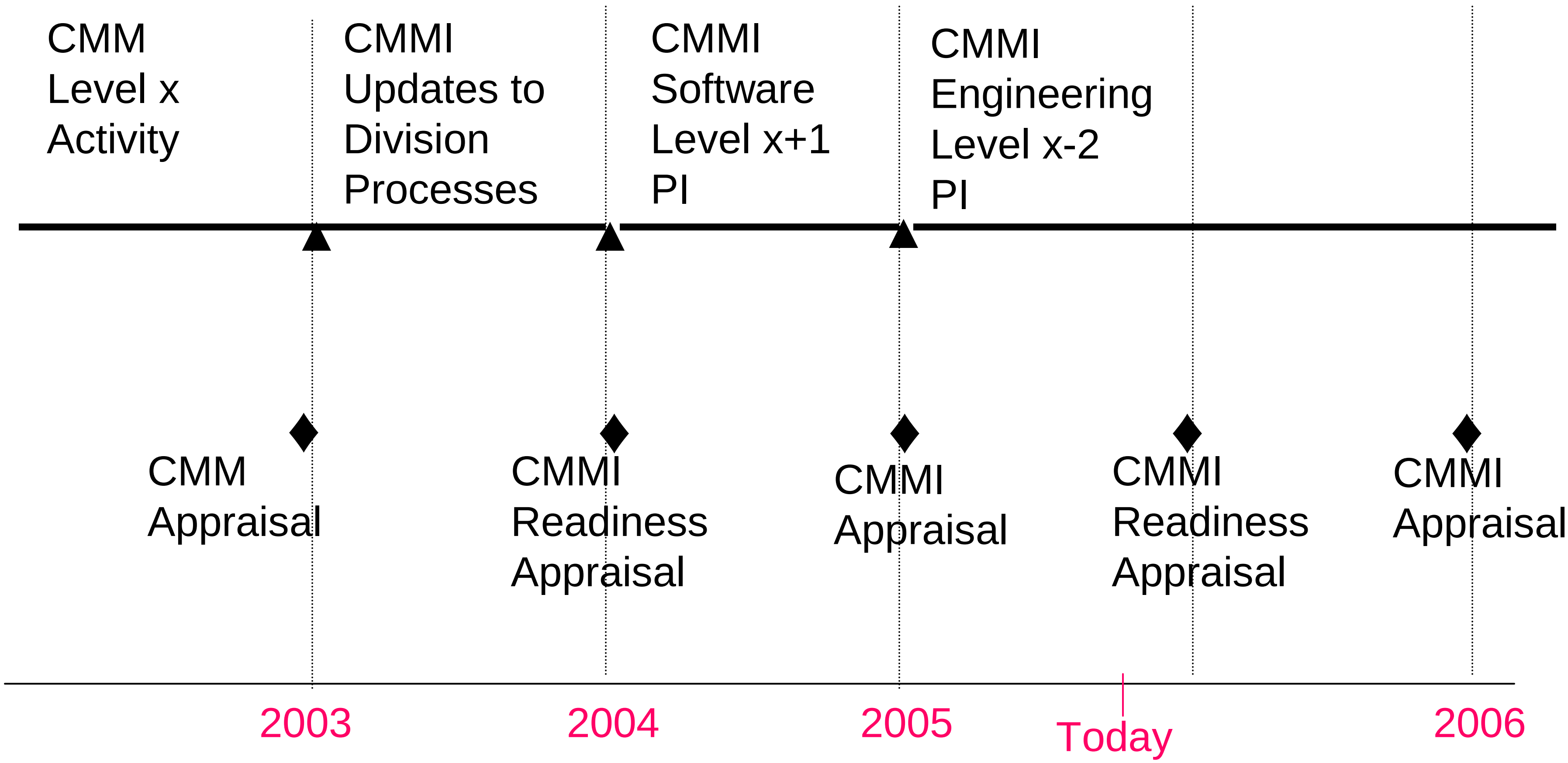
- Understanding and quantifying the benefits/losses of Process Improvement (PI) and Process (P) performance for the Program
  - Support decisions in planning and performing PI and P
  - Increase efficiency of Process Improvement (PI) and Process (P)

Context

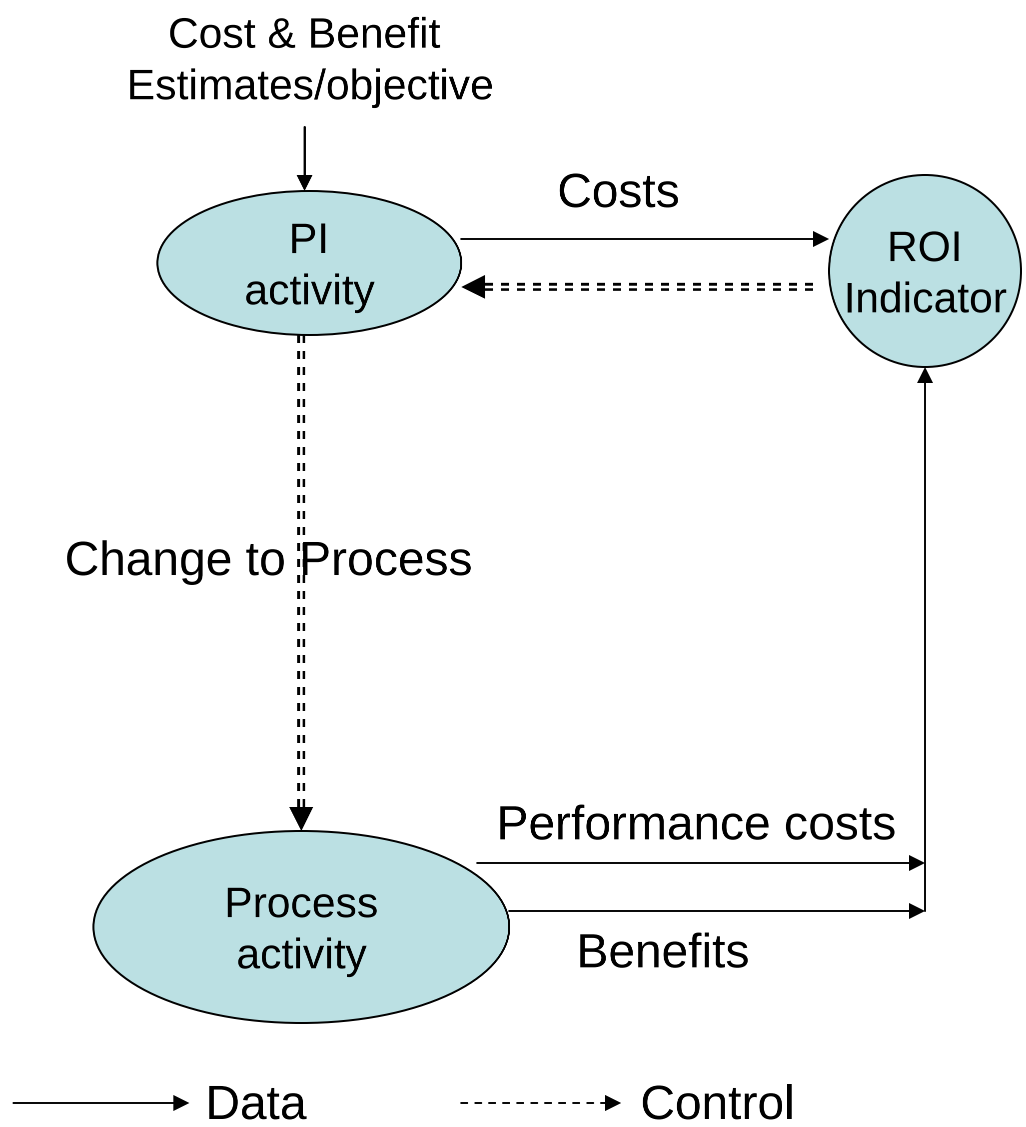


Disciplines
Software
Systems
Mechanical
Electrical
Controls

Process Milestones



Manage ROI

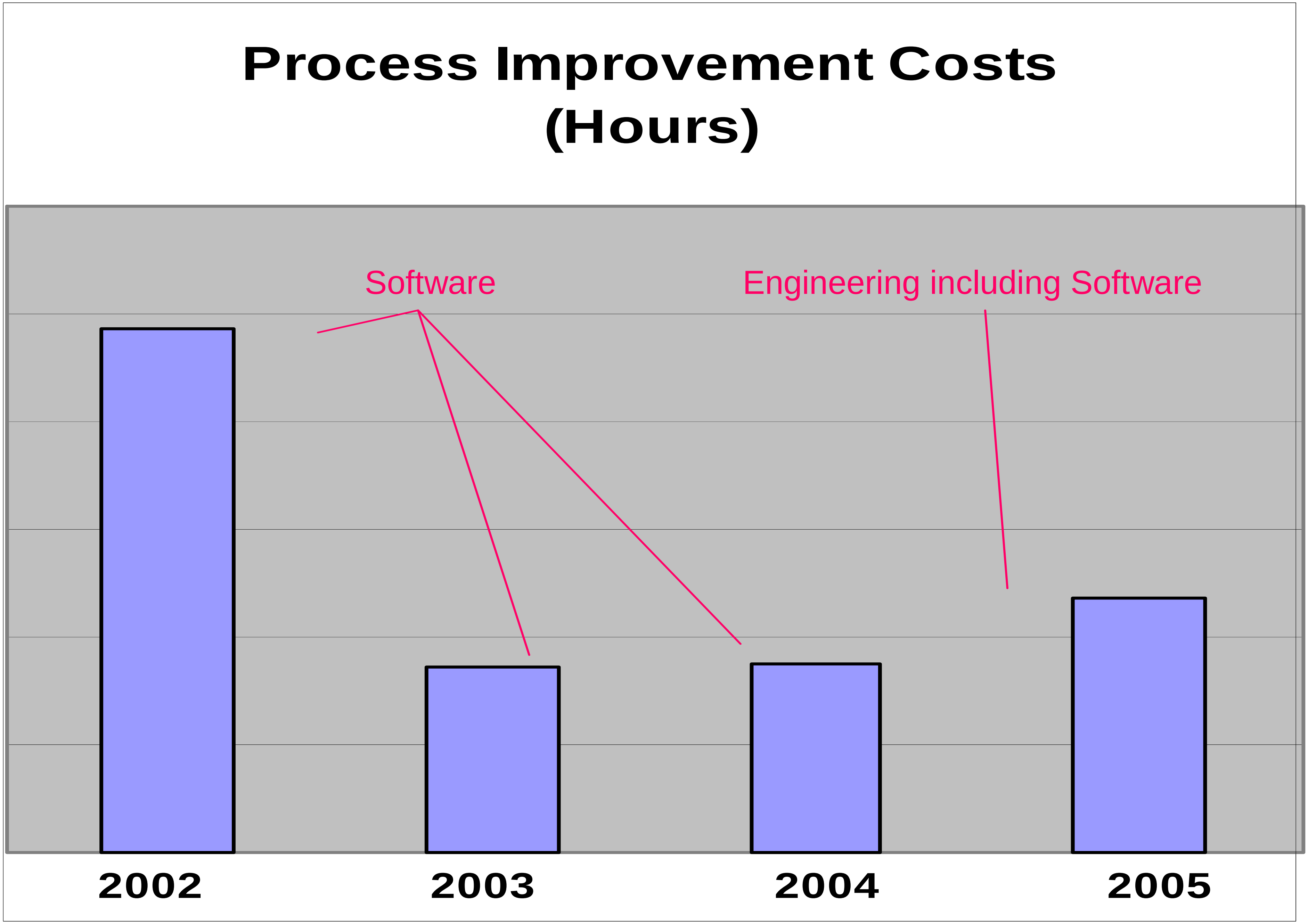


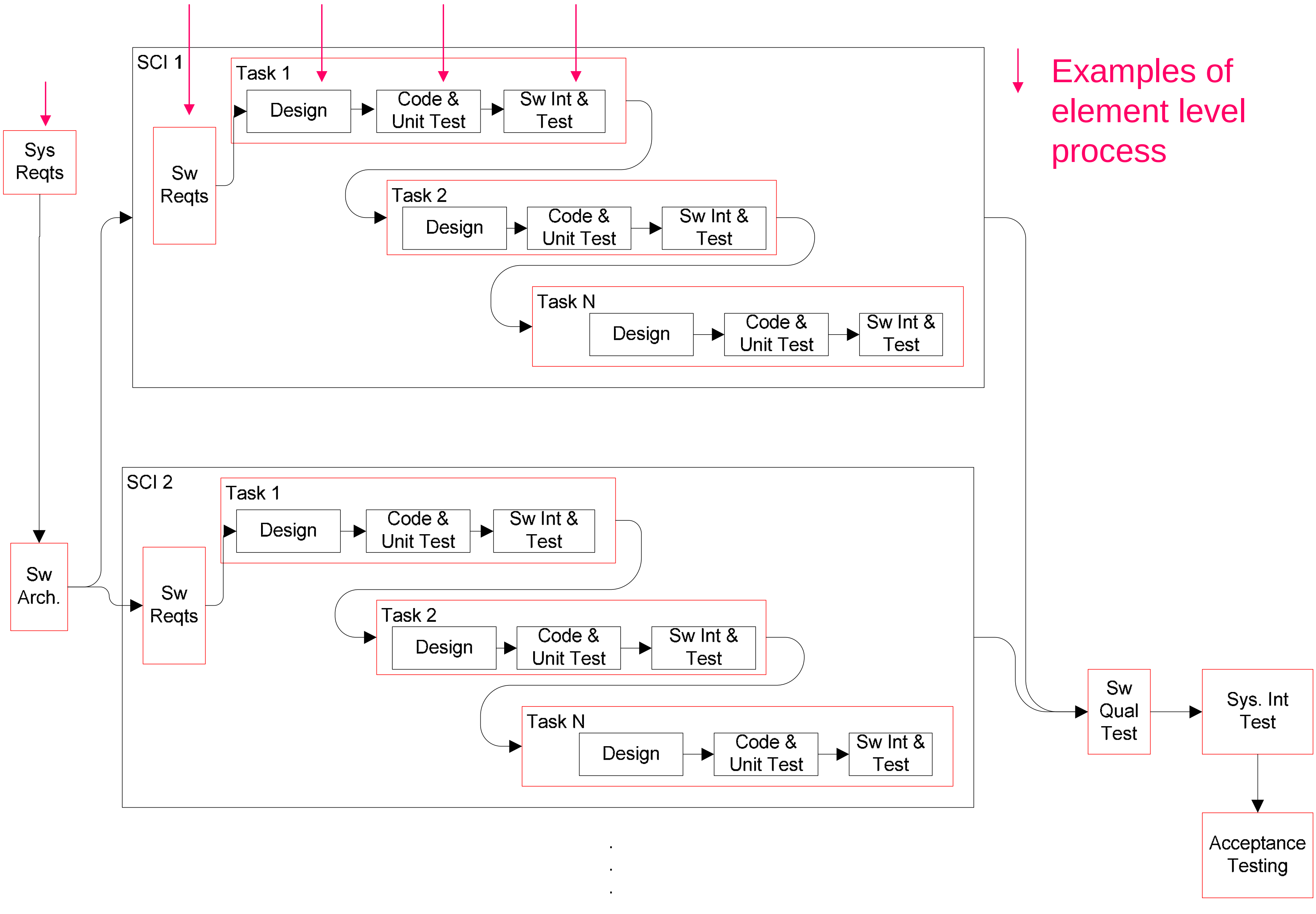
Actual Costs
- Management
- Process
  Development
- Training
- Compliance
- Appraisals
- Execution

Actual Benefits
- productivity gain
- effort decrease
- cycle time decrease
- rework decrease
- quality gain

Approach

- Benefits of the CMMI
  - Aggregate benefits at the process element level from CMMI-based improvements
    - Define ‘goodness’ measure for a process element
    - Measurements before, during, after the improvements


Process Improvement Costs
(Hours)
Software
Engineering including Software
2002
2003
2004
2005


Examples of element level process
Sys Reqts
Sw Arch.
SCI 1
Sw Reqts
Task 1
Design
Code & Unit Test
Sw Int & Test
Task 2
Design
Code & Unit Test
Sw Int & Test
Task N
Design
Code & Unit Test
Sw Int & Test
SCI 2
Sw Reqts
Task 1
Design
Code & Unit Test
Sw Int & Test
Task 2
Design
Code & Unit Test
Sw Int & Test
Task N
Design
Code & Unit Test
Sw Int & Test
Sw Qual Test
Sys. Int Test
Acceptance Testing

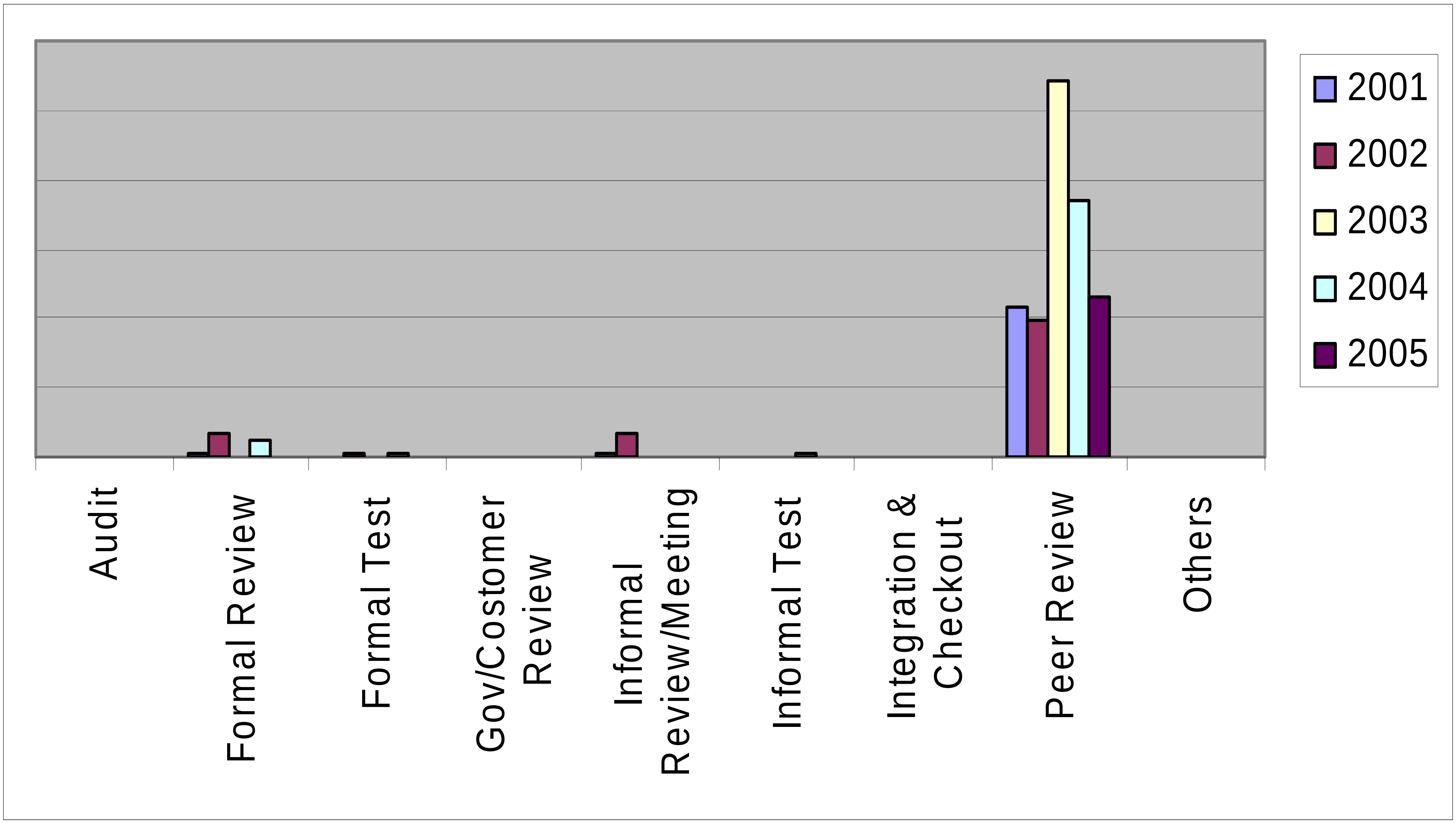
Process Element Example

- Peer reviews
- ‘Goodness’
  – Early identification of defects
  – Number of defects missed
  – Time to close defects
  – Predictability

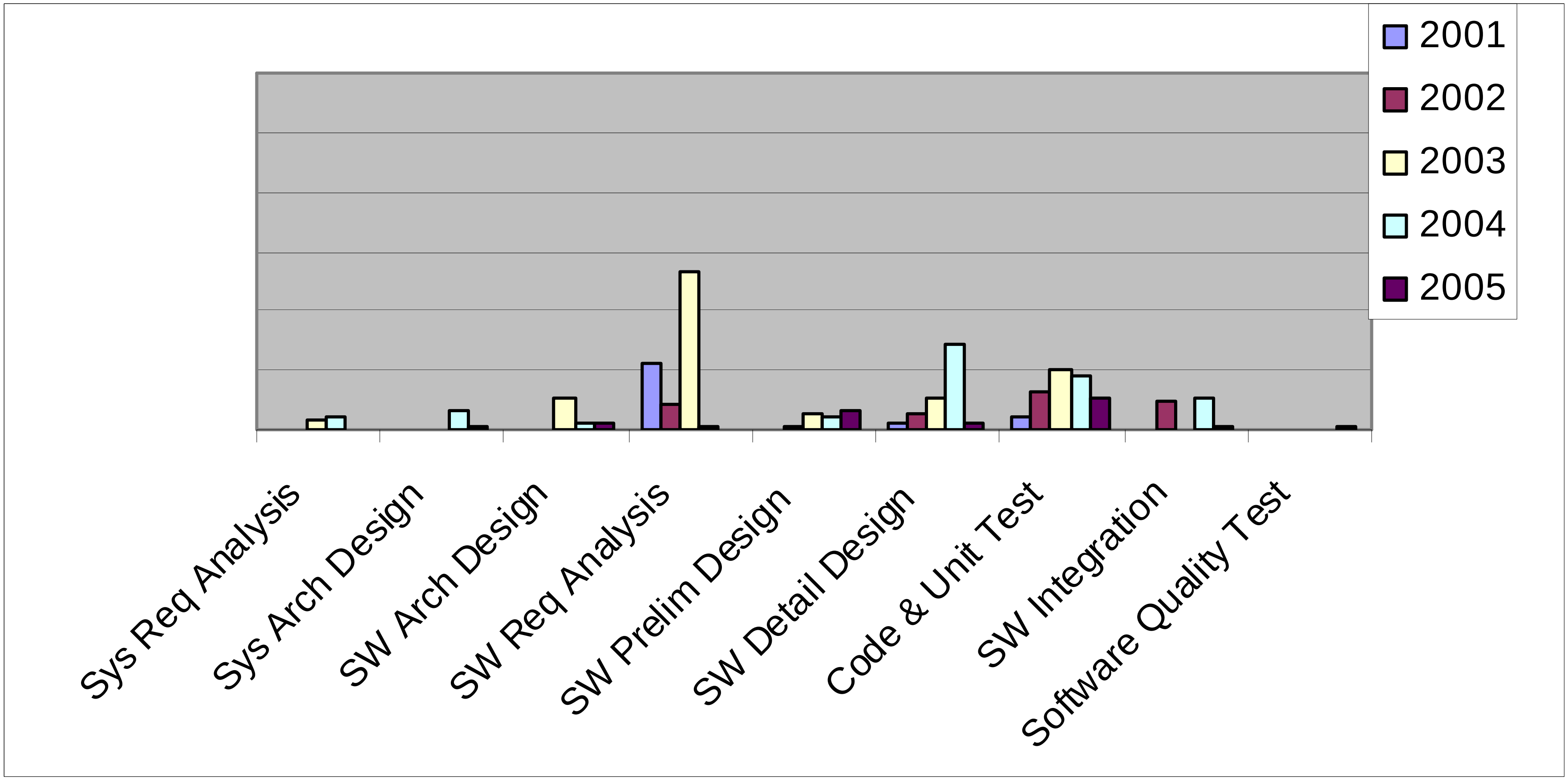
Data Categories for Defects

- Defects (Peer Review)
- Change requests
  - Developmental (CUT)
  - Formal (Test)
- Issues

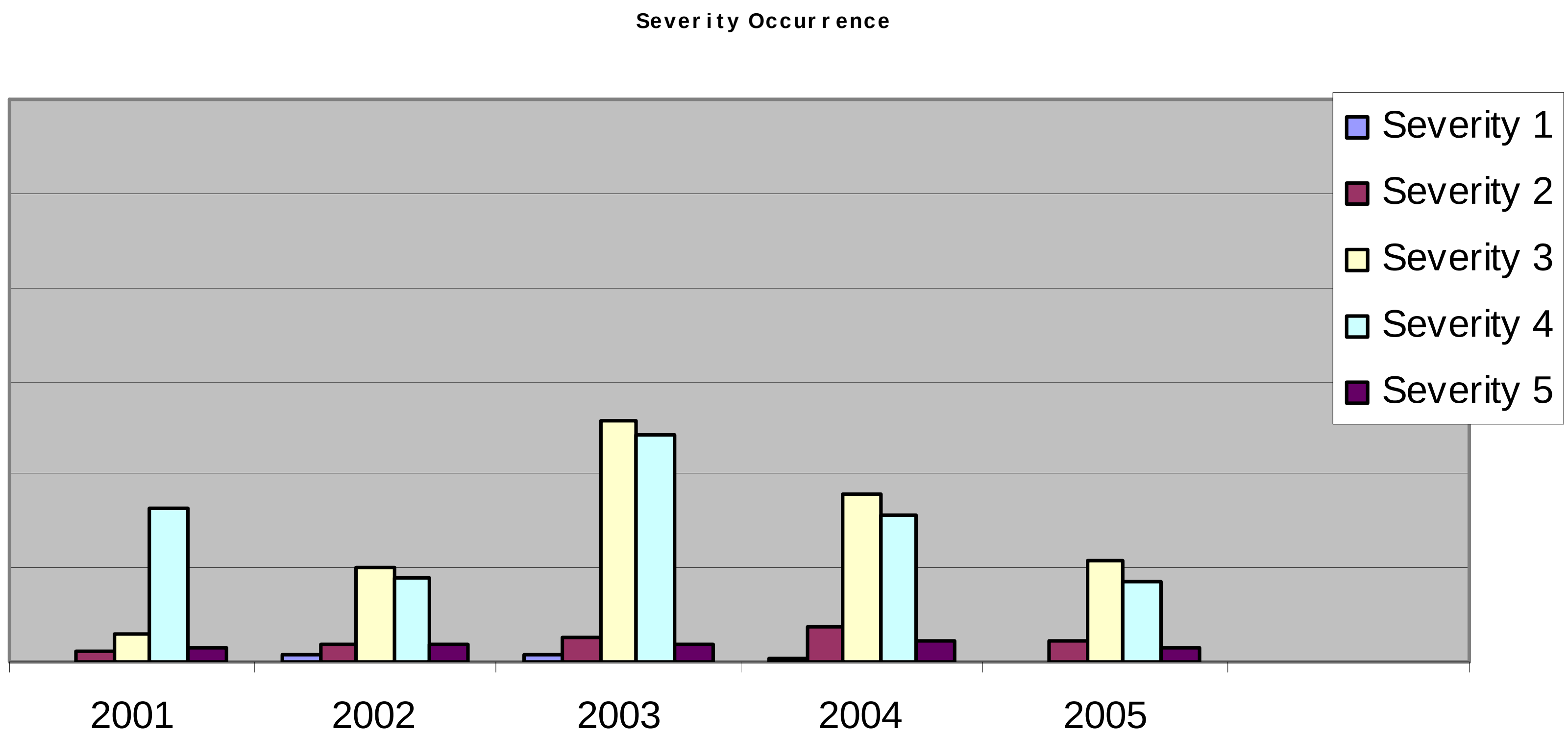
Finding Defects



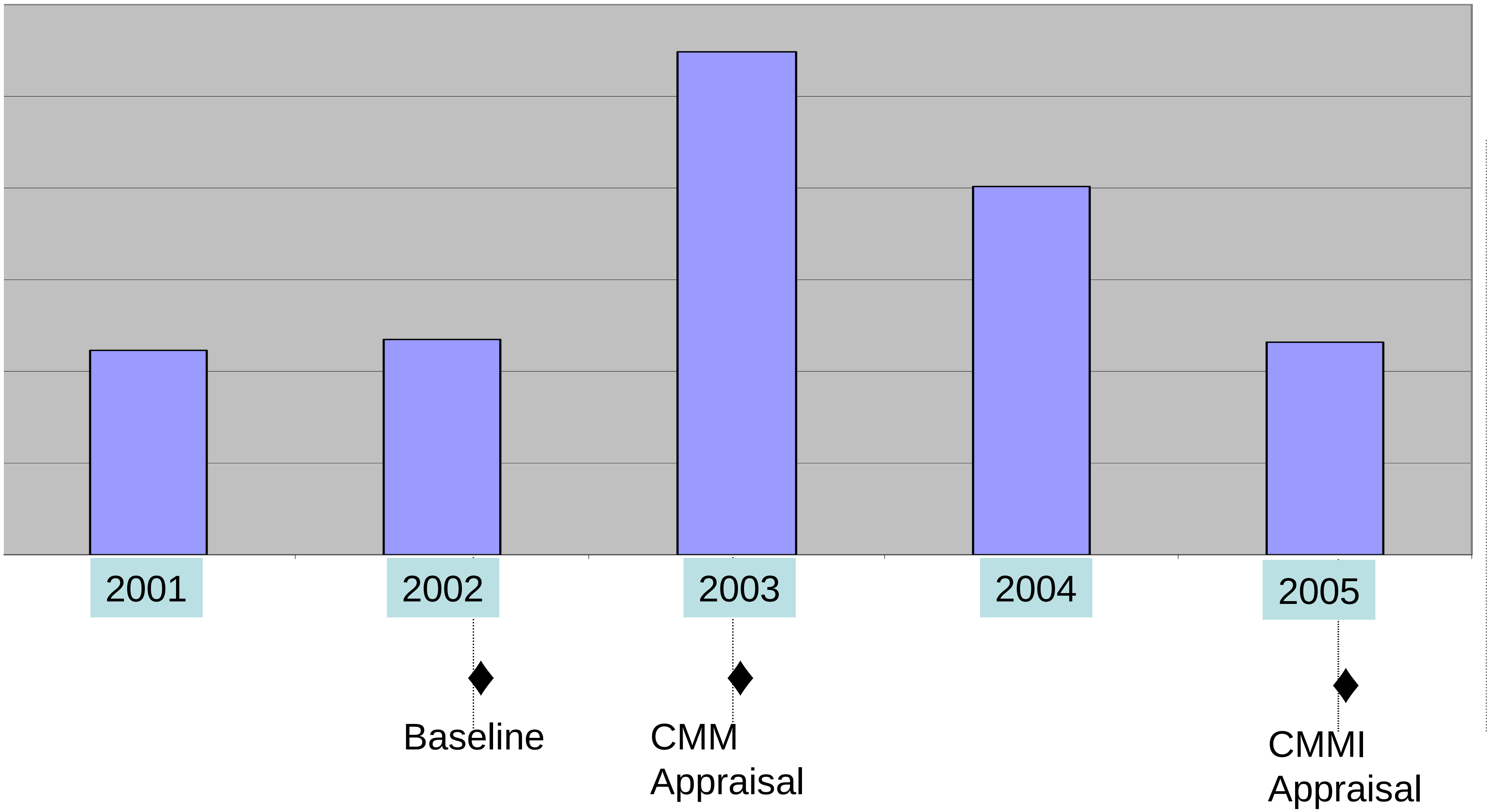
Defect Origin

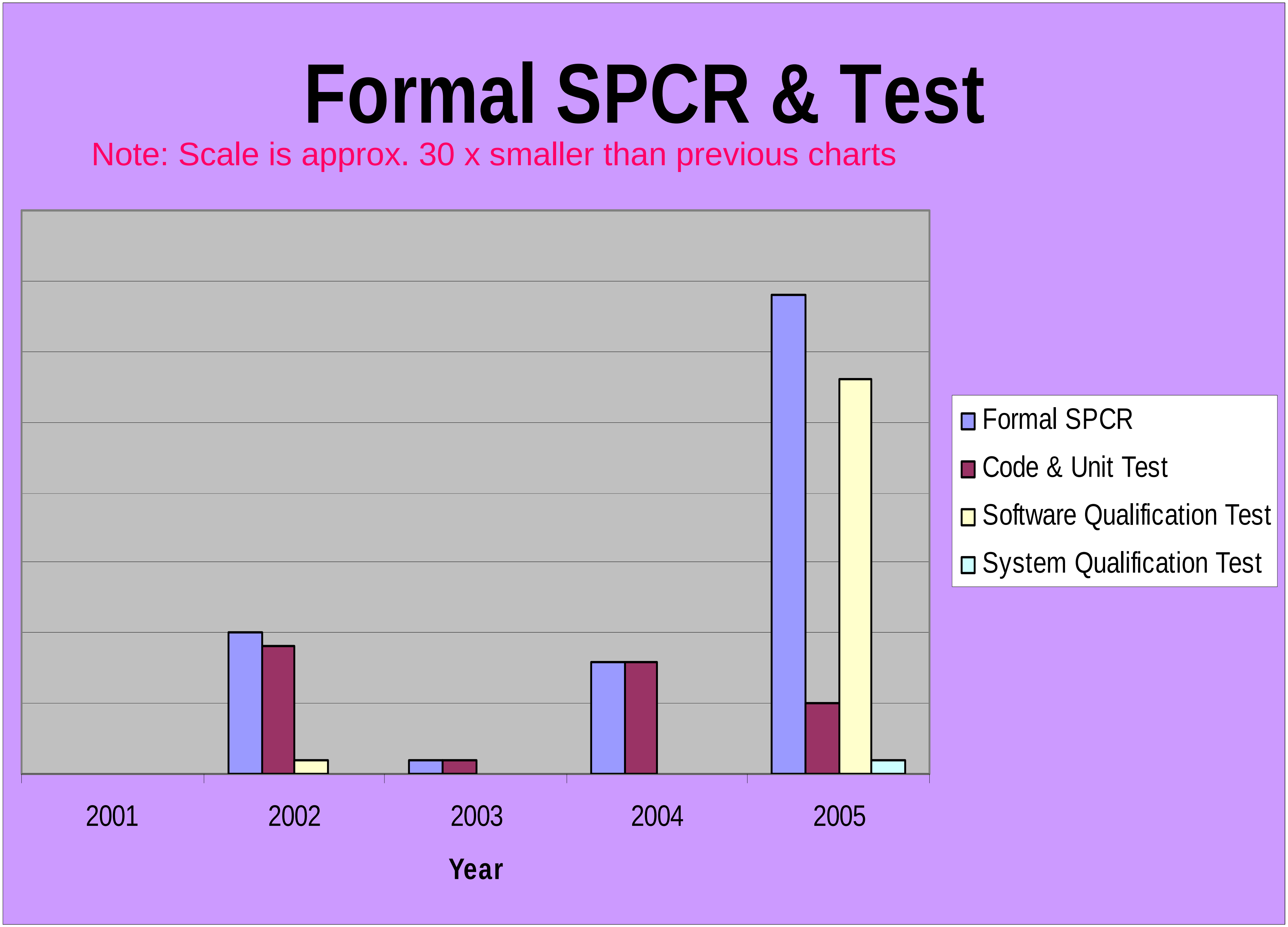


Severity Occurrence

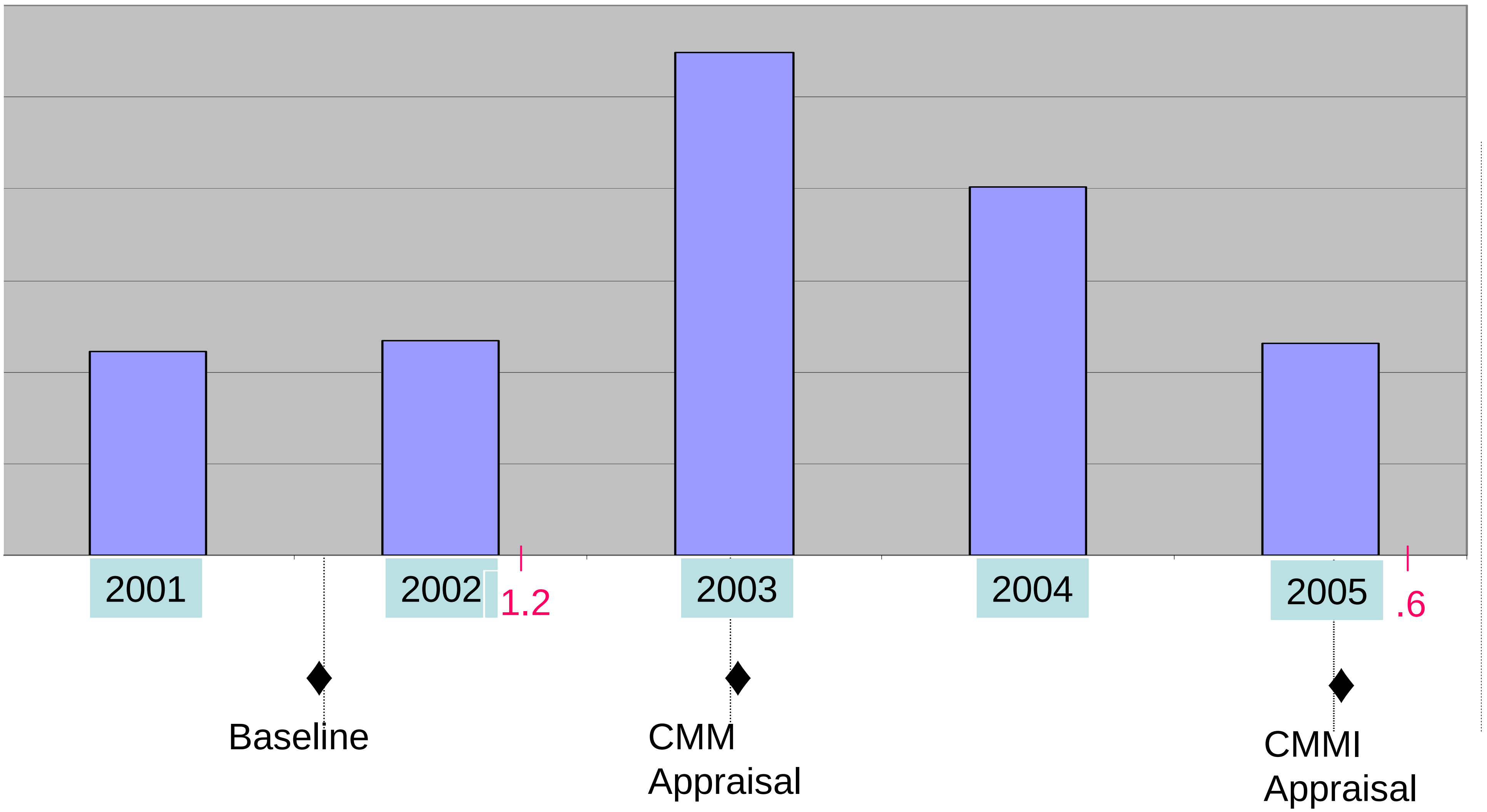


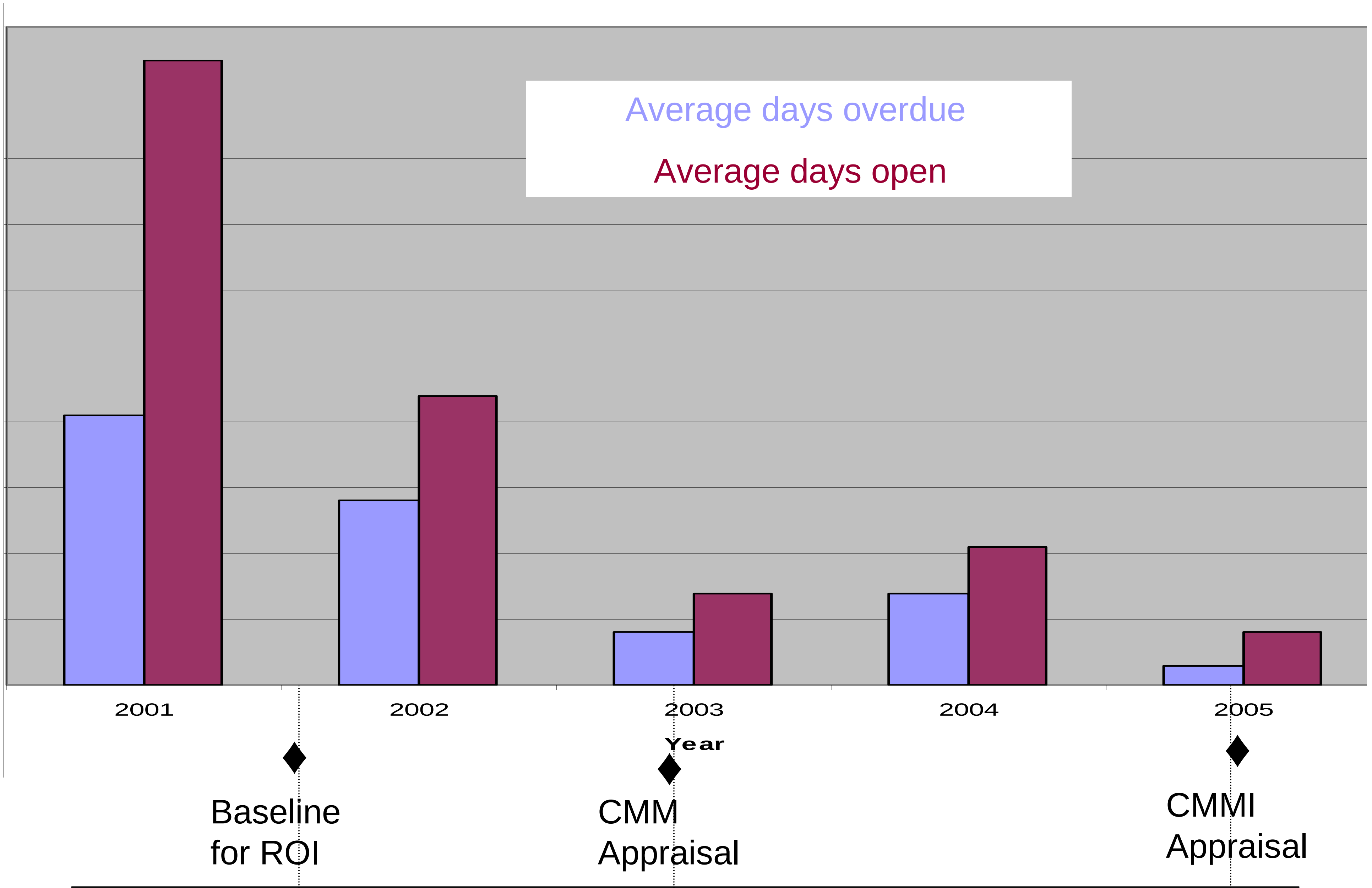
Peer Review Defect Data




Formal SPCR & Test
Note: Scale is approx. 30 x smaller than previous charts
Formal SPCR
Code & Unit Test
Software Qualification Test
System Qualification Test
2001
2002
2003
2004
2005
Year

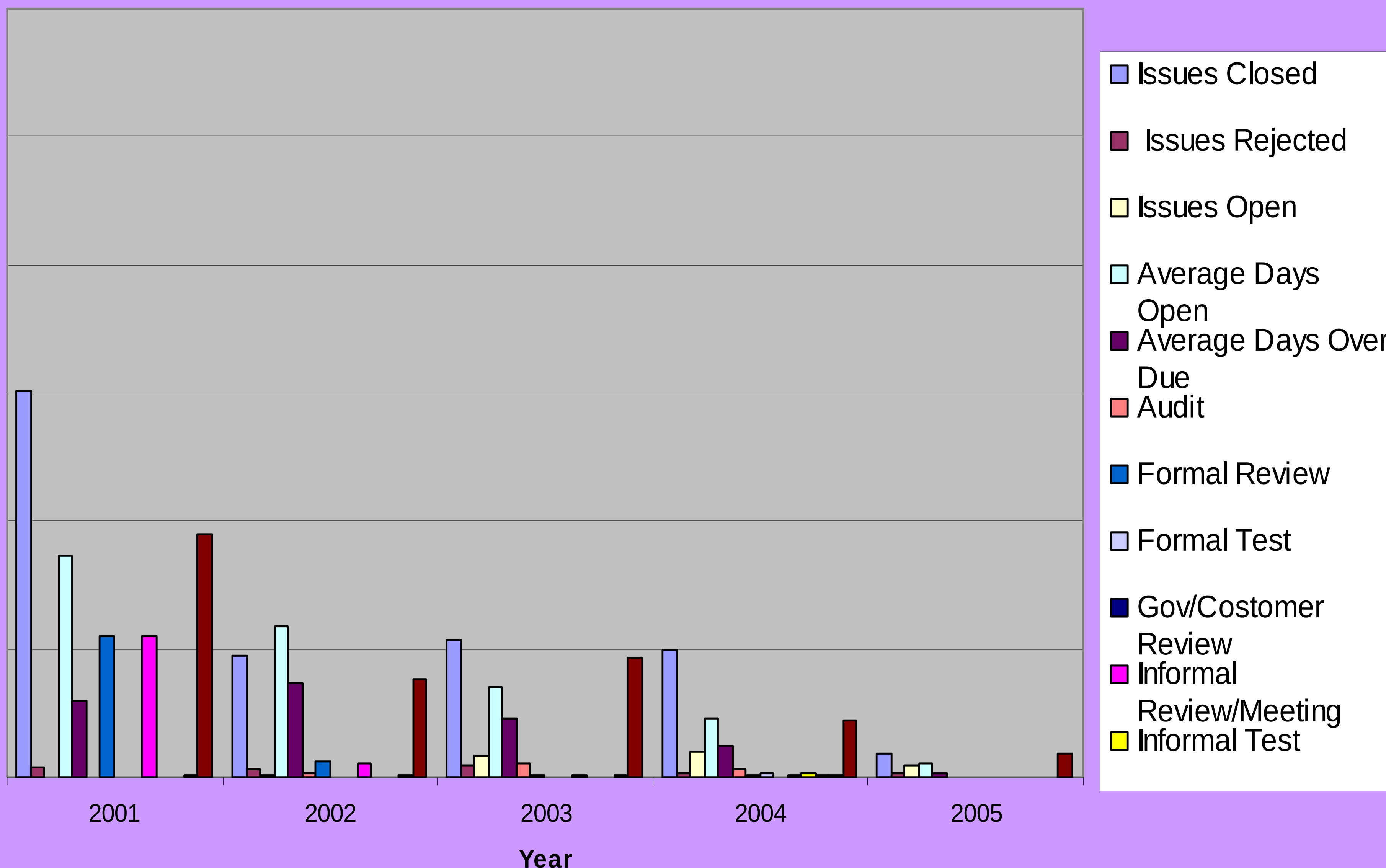
Peer Review Defect Data



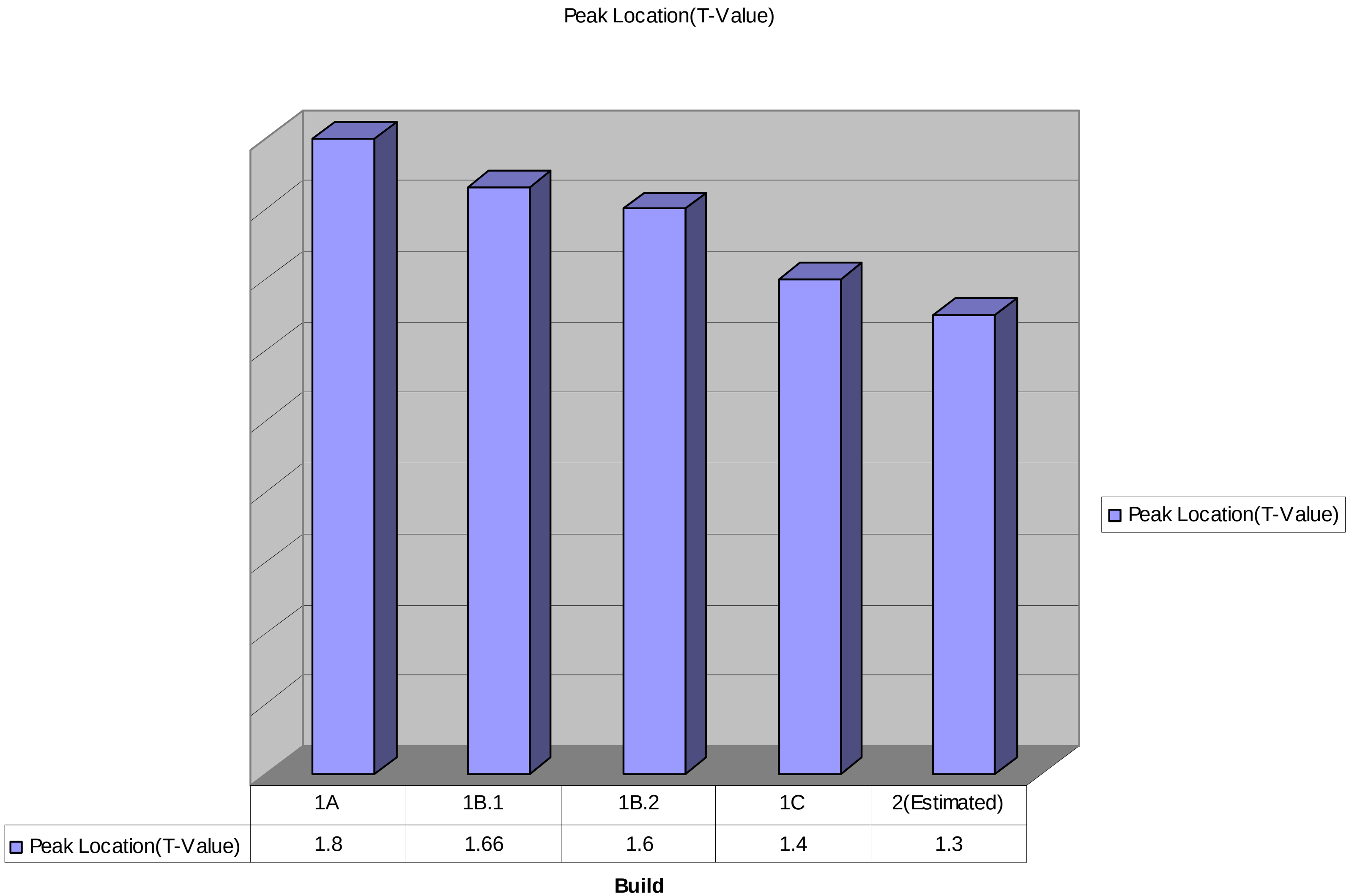


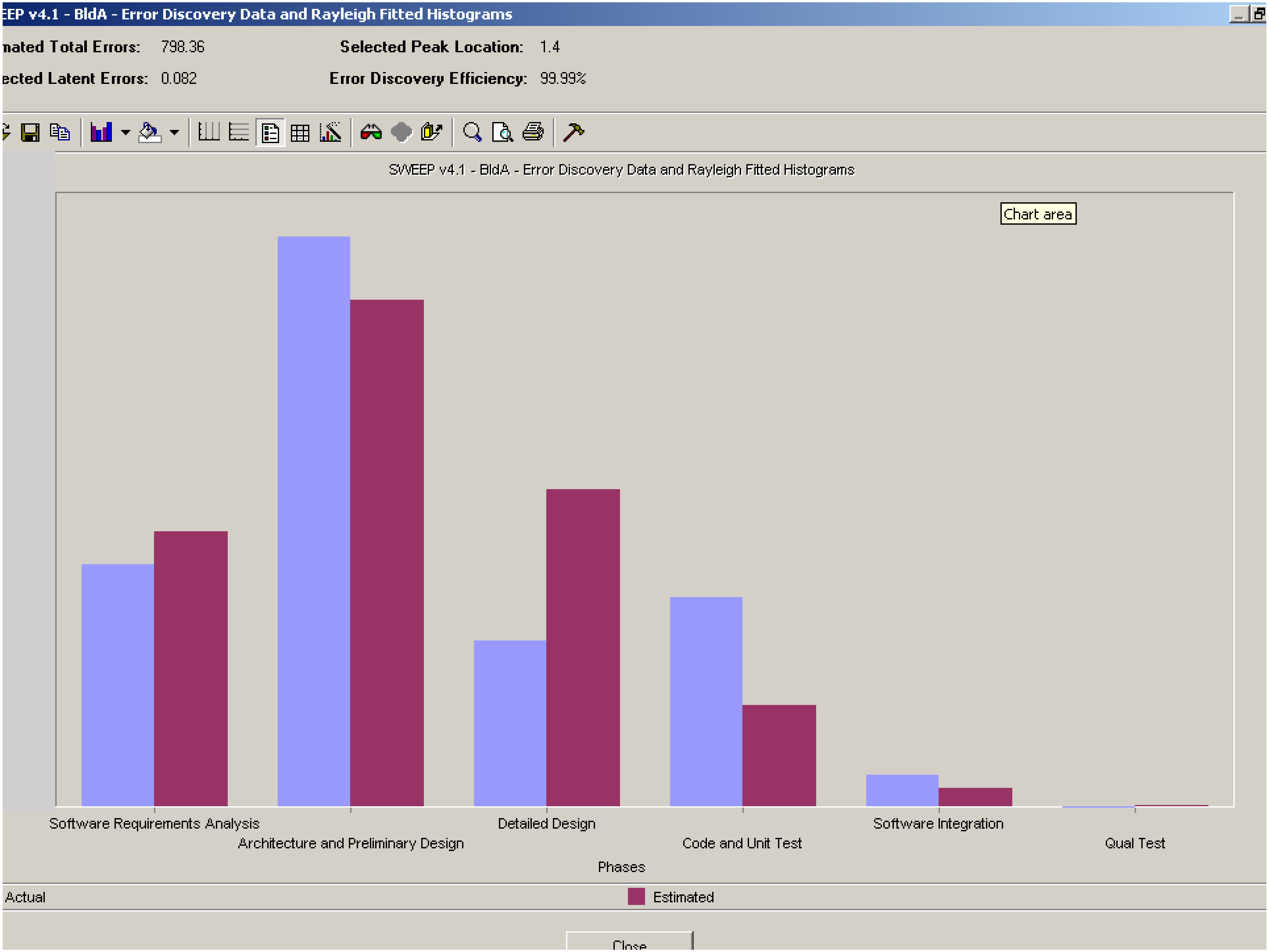
Average days overdue
Average days open
2001
2002
2003
2004
2005
Year
Baseline for ROI
CMM Appraisal
CMMI Appraisal

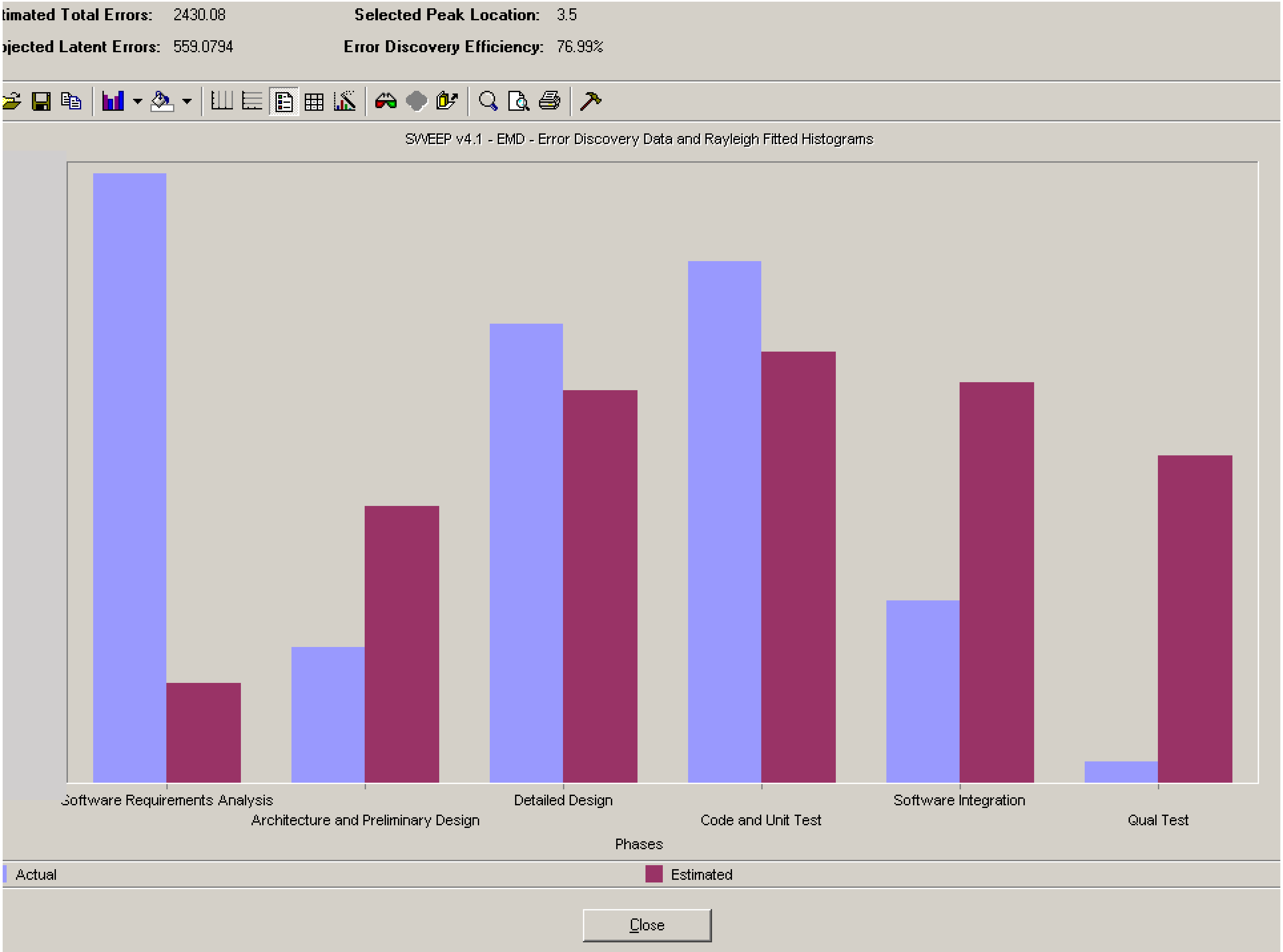
Issue, Generating Activity

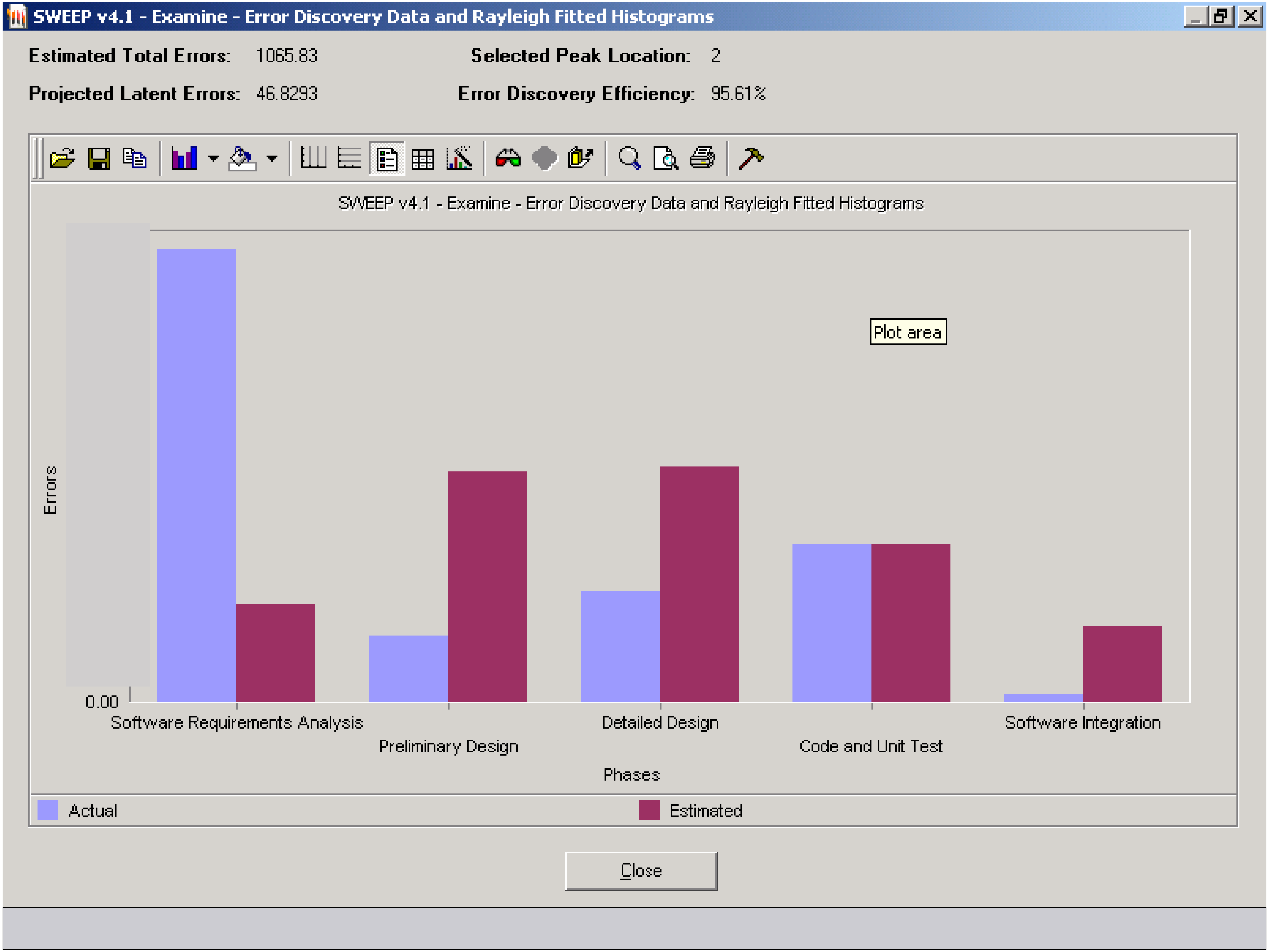


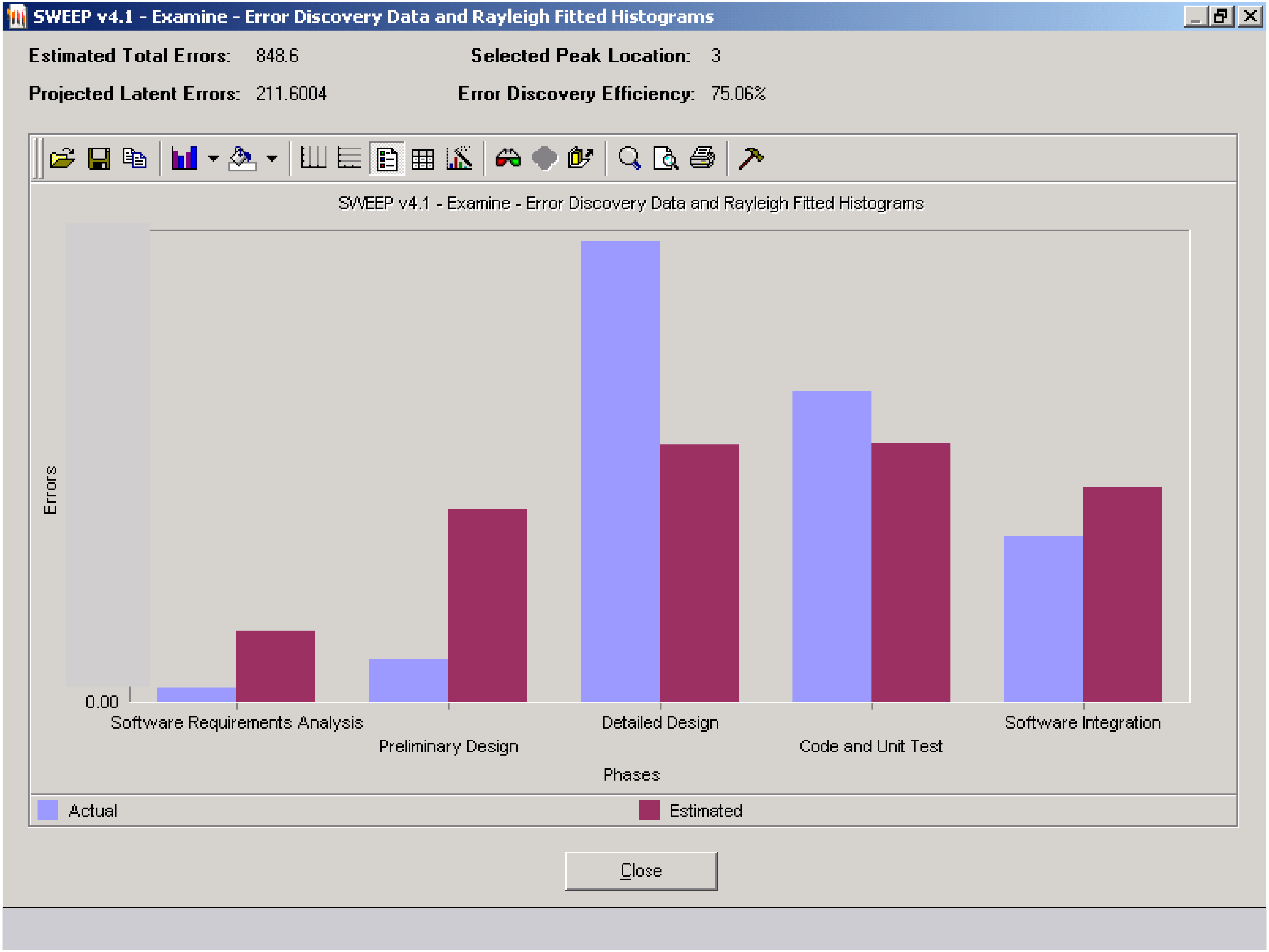
Sweep Peak (T) Value



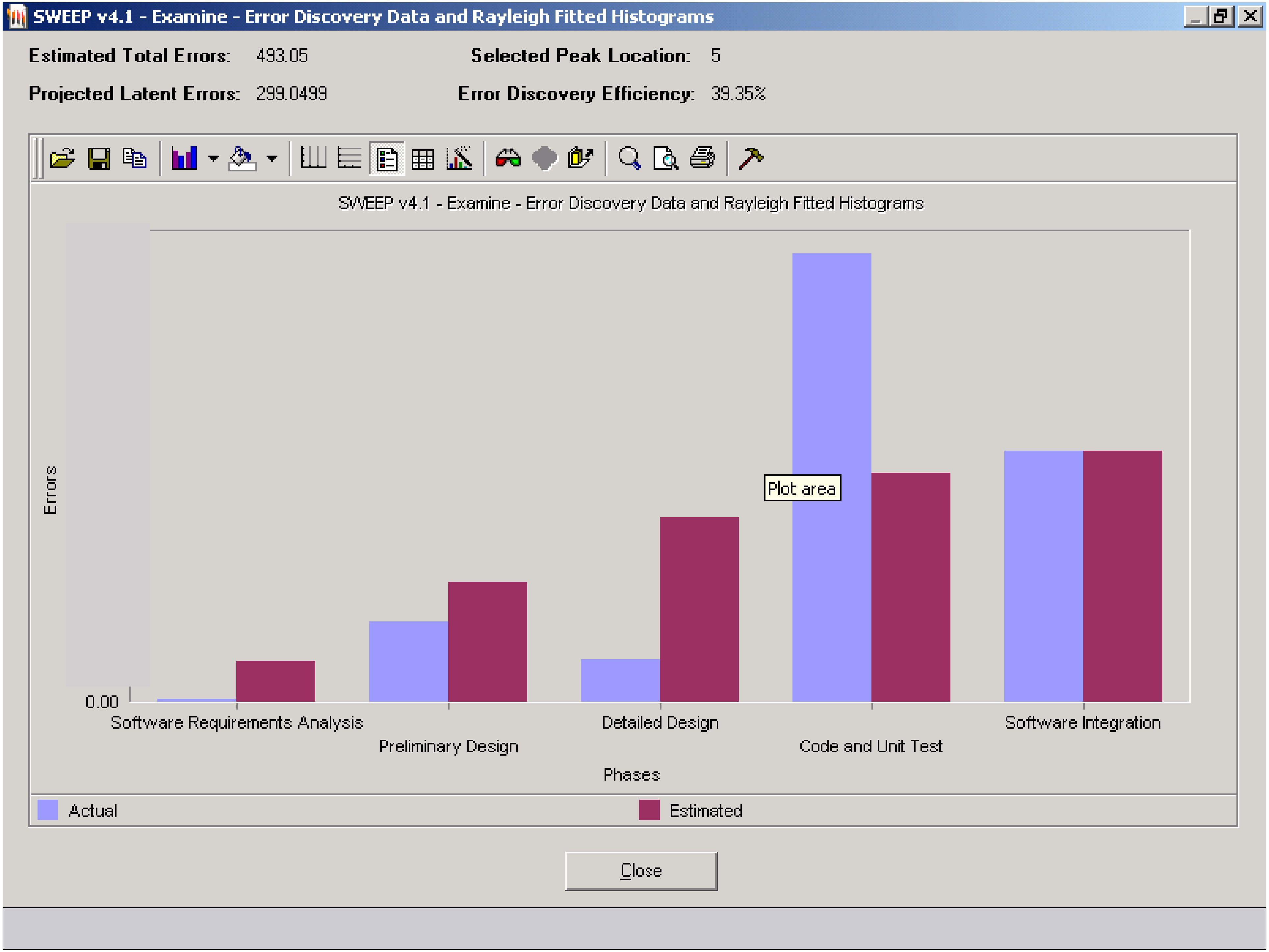

EEP v4.1 - BldA - Error Discovery Data and Rayleigh Fitted Histograms
nated Total Errors: 798.36
Selected Peak Location: 1.4
ected Latent Errors: 0.082
Error Discovery Efficiency: 99.99%
SWEEP v4.1 - BldA - Error Discovery Data and Rayleigh Fitted Histograms
Chart area
Software Requirements Analysis
Architecture and Preliminary Design
Detailed Design
Code and Unit Test
Software Integration
Qual Test
Phases
Actual
Estimated
Close


timated Total Errors: 2430.08
Selected Peak Location: 3.5
jected Latent Errors: 559.0794
Error Discovery Efficiency: 76.99%
SWEEP v4.1 - EMD - Error Discovery Data and Rayleigh Fitted Histograms
Software Requirements Analysis
Architecture and Preliminary Design
Detailed Design
Code and Unit Test
Software Integration
Qual Test
Phases
Actual
Estimated
Close


SWEEP v4.1 - Examine - Error Discovery Data and Rayleigh Fitted Histograms
Estimated Total Errors: 1065.83
Selected Peak Location: 2
Projected Latent Errors: 46.8293
Error Discovery Efficiency: 95.61%
SWEEP v4.1 - Examine - Error Discovery Data and Rayleigh Fitted Histograms
Plot area
Errors
0.00
Software Requirements Analysis
Preliminary Design
Detailed Design
Code and Unit Test
Software Integration
Phases
Actual
Estimated
Close



SWEEP v4.1 - Examine - Error Discovery Data and Rayleigh Fitted Histograms
Estimated Total Errors: 848.6
Selected Peak Location: 3
Projected Latent Errors: 211.6004
Error Discovery Efficiency: 75.06%
SWEEP v4.1 - Examine - Error Discovery Data and Rayleigh Fitted Histograms
Errors
0.00
Software Requirements Analysis
Preliminary Design
Detailed Design
Code and Unit Test
Software Integration
Phases
Actual
Estimated
Close


SWEEP v4.1 - Examine - Error Discovery Data and Rayleigh Fitted Histograms
Estimated Total Errors: 493.05
Selected Peak Location: 5
Projected Latent Errors: 299.0499
Error Discovery Efficiency: 39.35%
SWEEP v4.1 - Examine - Error Discovery Data and Rayleigh Fitted Histograms
Errors
0.00
Plot area
Software Requirements Analysis
Preliminary Design
Detailed Design
Code and Unit Test
Software Integration
Phases
Actual
Estimated
Close

Benefits / ROI

- Earlier detection of defects
  - 1.2 defects per ksloc to .6 defects per ksloc at Software Integration and Test
- Time to close defects decreasing
- Number of issues declining
- ROI using cost of all Process Improvement and only defect related benefits (ignoring all other benefits) = 1.6

Summary

- Single program
- Trend data from 2002 to 2005
  - CMM Level 3 (2002-2003)
  - CMM Level 4 (2003-2005)
  - CMMI Level 5 (2005-)
- Examined defect data
- Defect benefit / Total PI cost = 1.6

CMMI® Current State and Future Plans

Bob Rassa, Raytheon
Industry CMMI Chair

Clyde Chittister
Chief Operating Officer,
Software Engineering Institute

Sponsored by the U.S. Department of Defense

STRENGTH THROUGH INDUSTRY & TECHNOLOGY

Topics

- Appraisal Results
- Transition Status
- Product Suite V1.2 Update
- Summary

Current Appraisal Synopsis

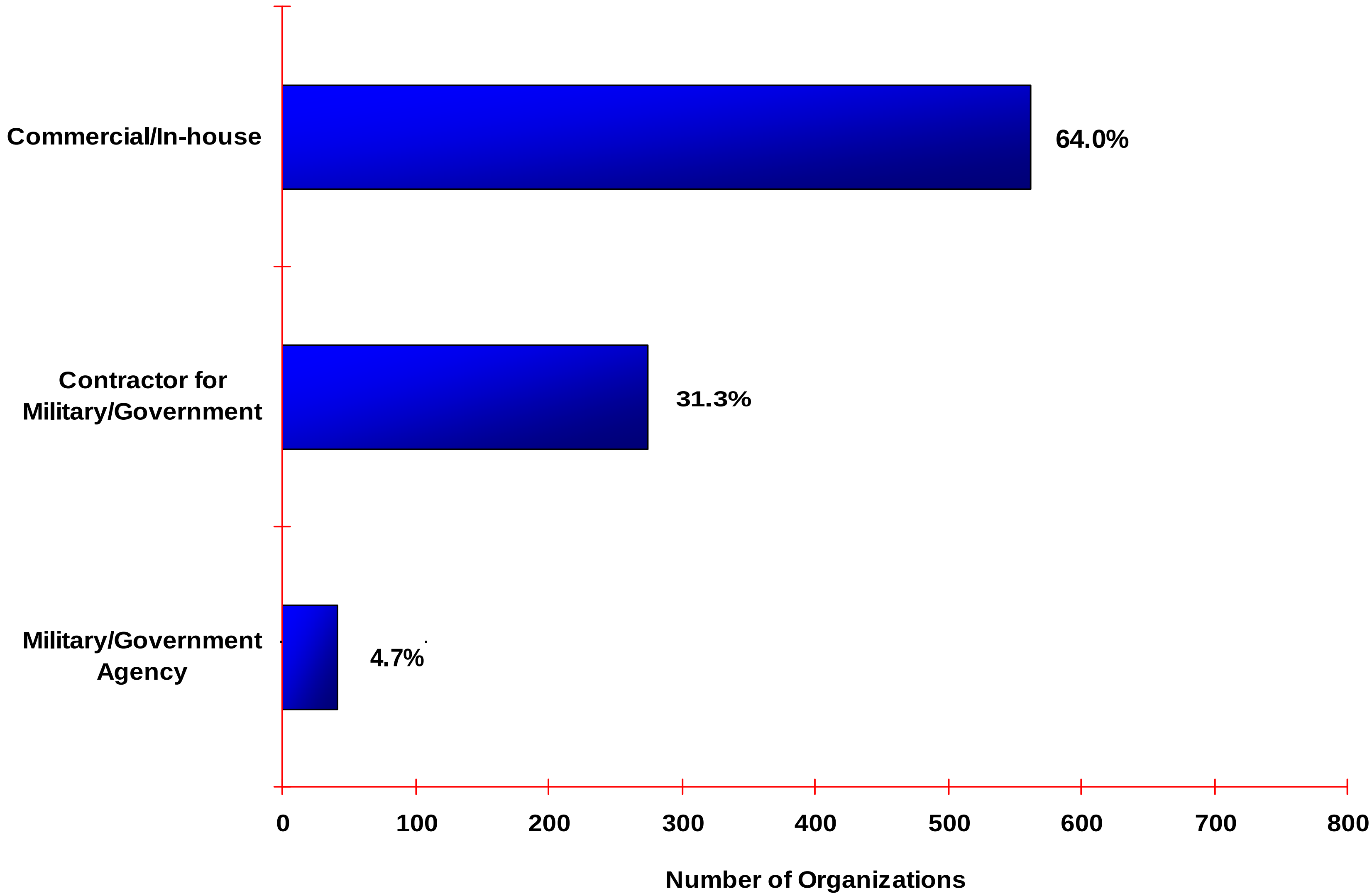
Based on SCAMPI[SM] V1.1 Class A appraisals conducted since April 2002 release through August 2005 and reported to the SEI by September 2005.

- **977 appraisals**
- **878 organizations**
- **206 participating companies**
- **86 reappraised organizations**
- **3,686 projects**
- **59.6% non-USA organizations**

***** Organizations previously appraised against CMMI V1.0 and who have not reappraised against V1.1 are not included in this report.

Please visit http://www.sei.cmu.edu/sema/profile_about.html for additional information or to find answers to questions you may have about this briefing, before contacting the SEI directly.

Reporting Organizational Types

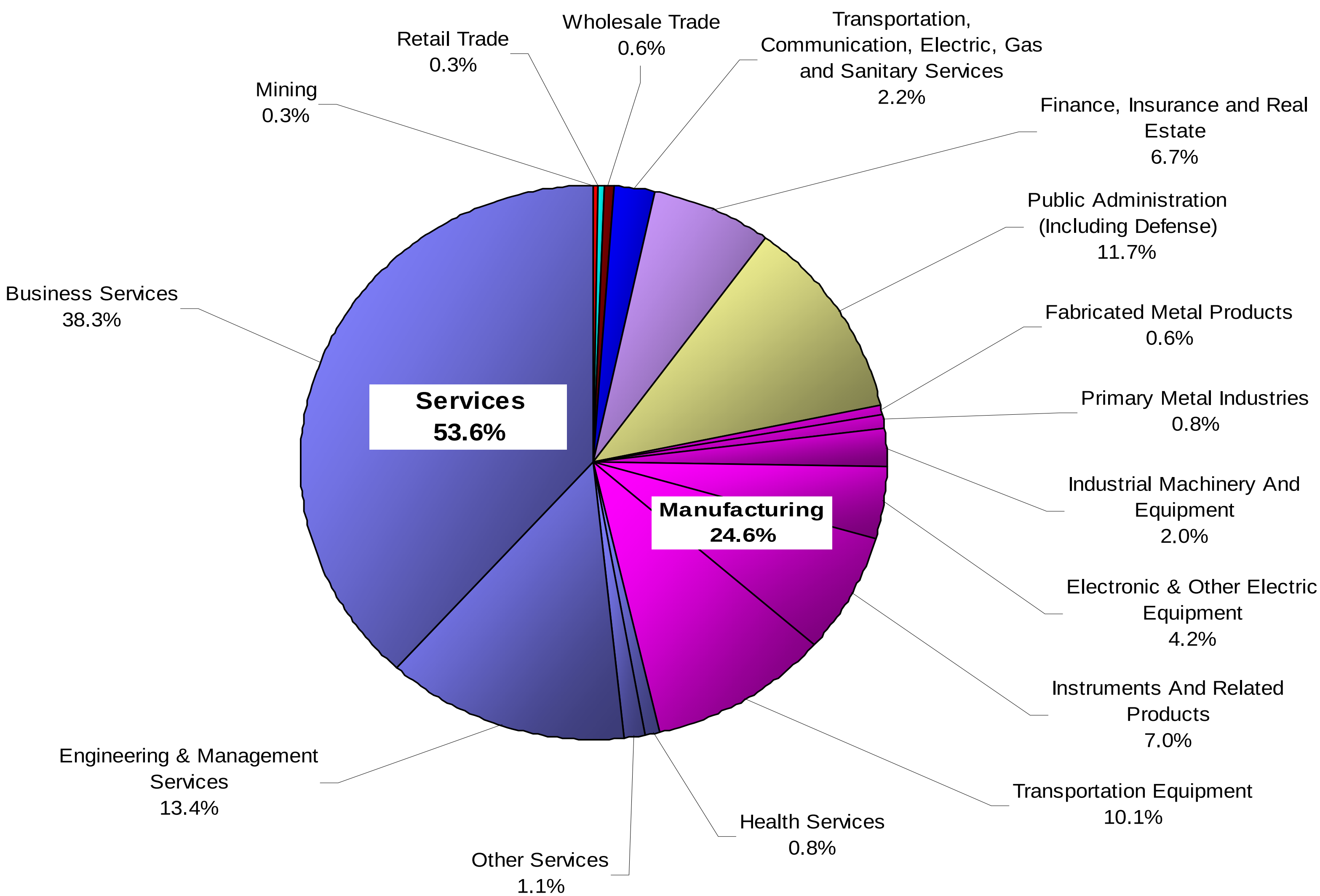


Based on **878** organizations

9/30/05

Organizations Type

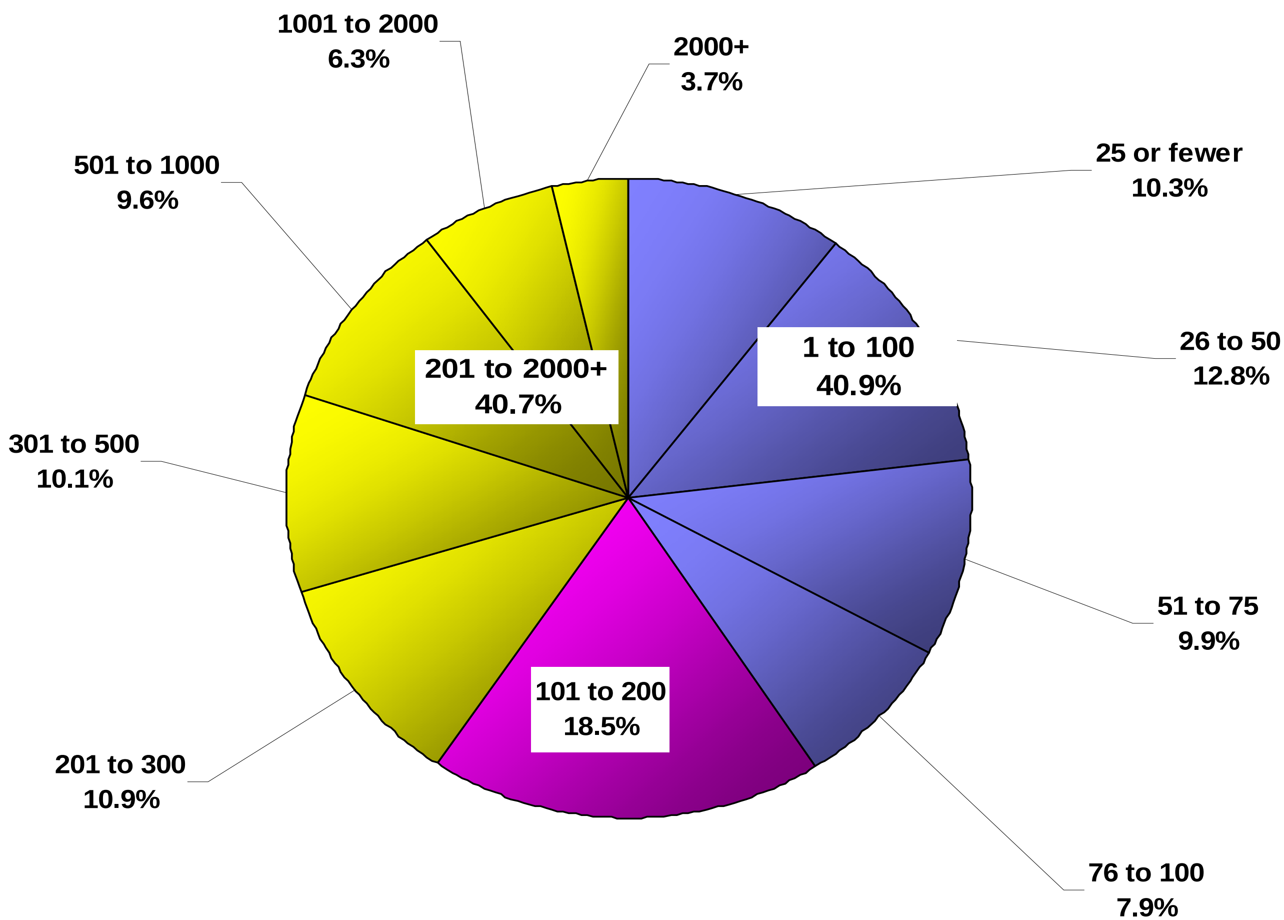
Based on Primary Standard Industrial Classification (SIC) Code



Based on **358** organizations reporting SIC code. For more information visit: http://www.osha.gov/oshstats/sicser.html **9/30/05**

Organizational Size

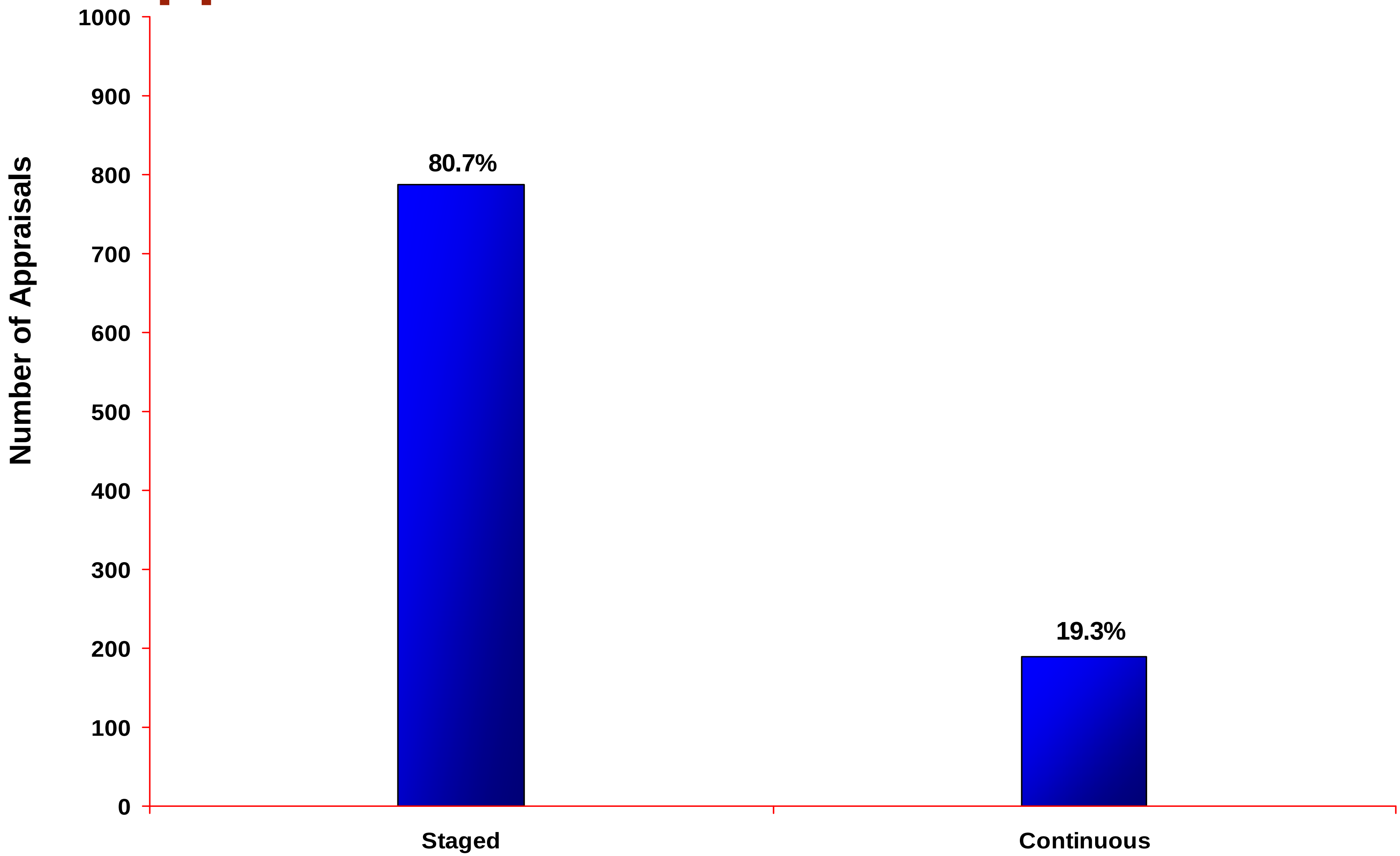
Based on the total number of employees within the area of the organization that was appraised



Based on **861** organizations reporting size data

9/30/05

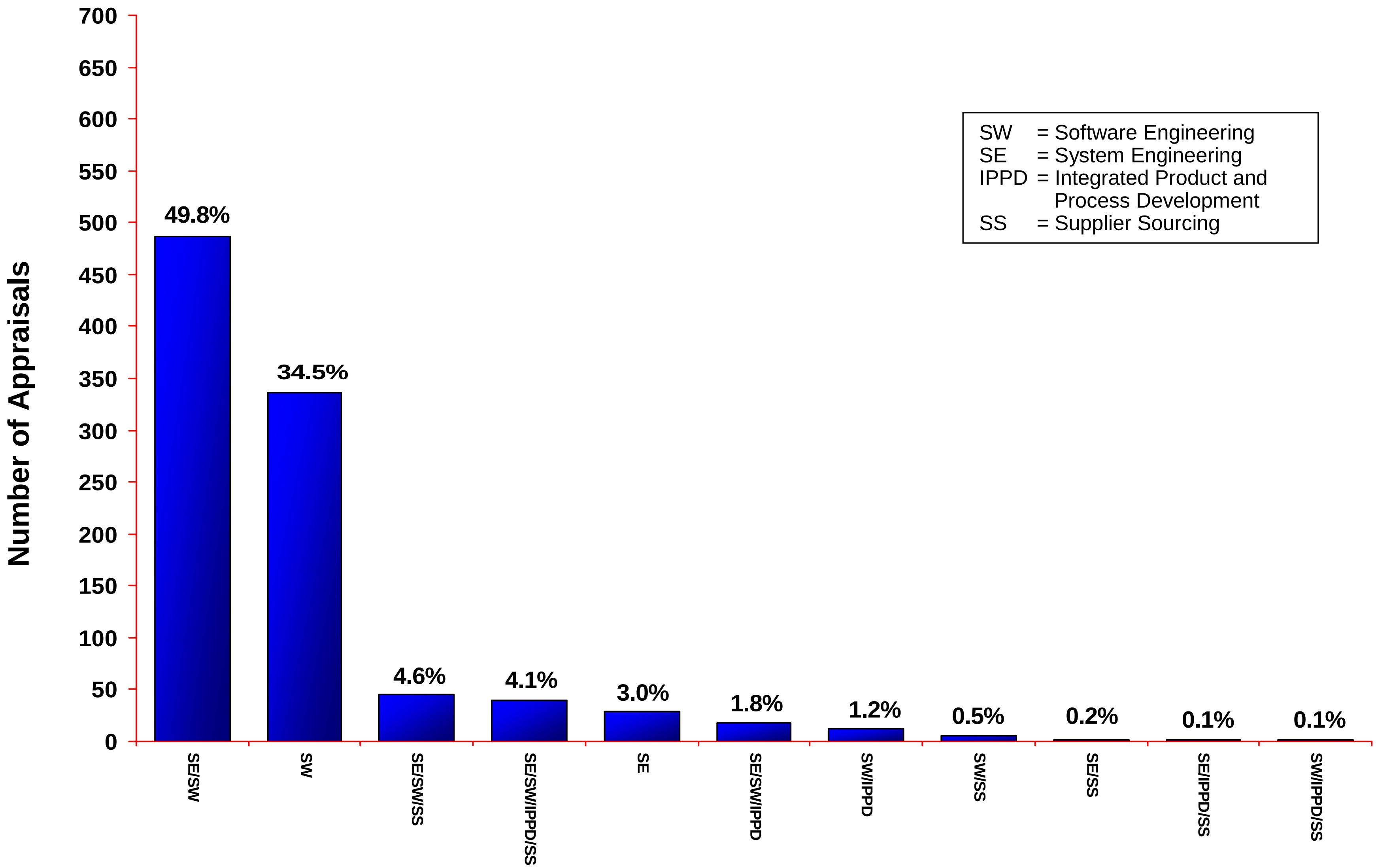
Model Representations Selected for Appraisals



Based on **977** appraisals

9/30/05

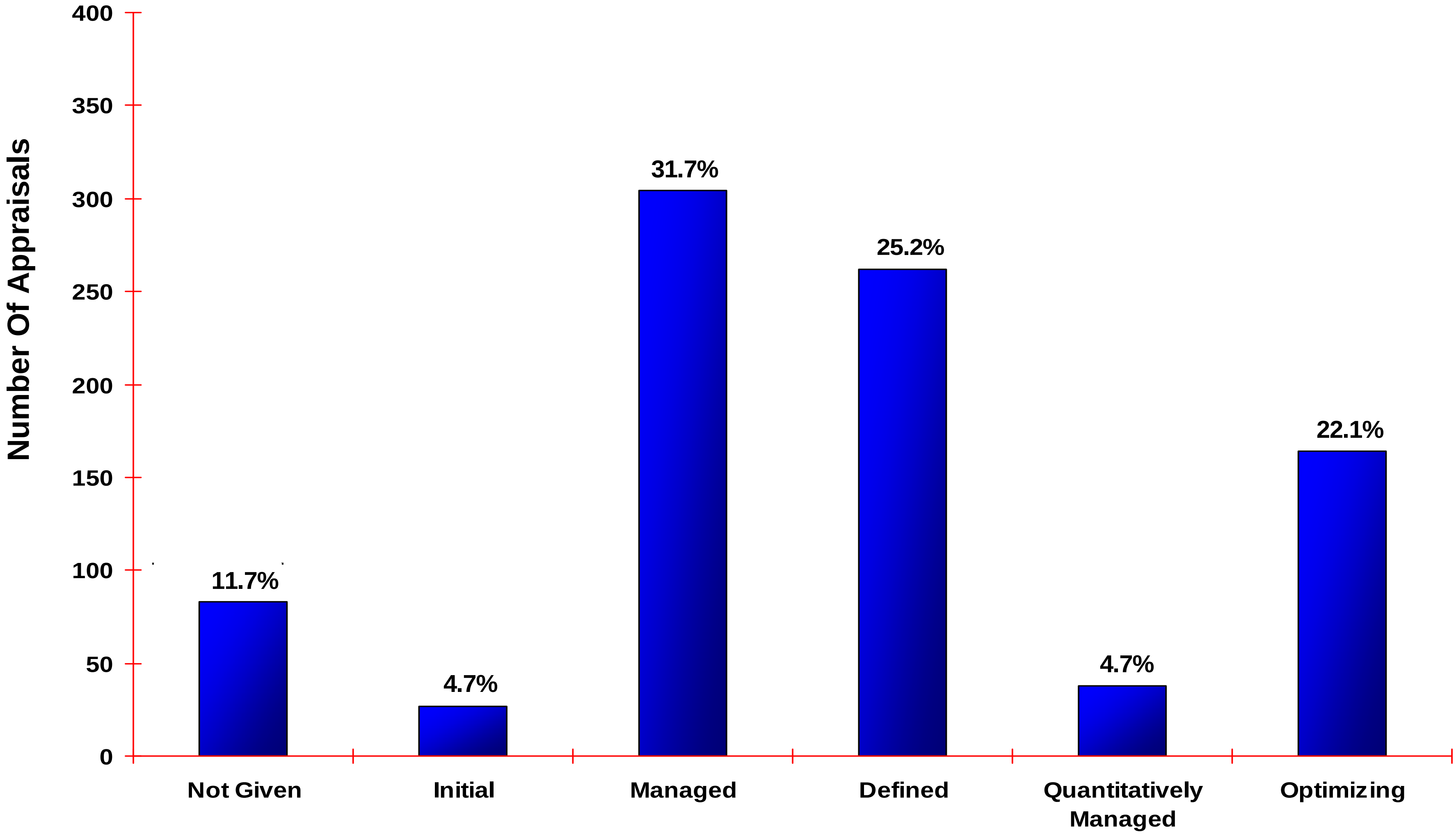
Disciplines Selected for Appraisals



Based on **977** appraisals reporting coverage

9/30/05

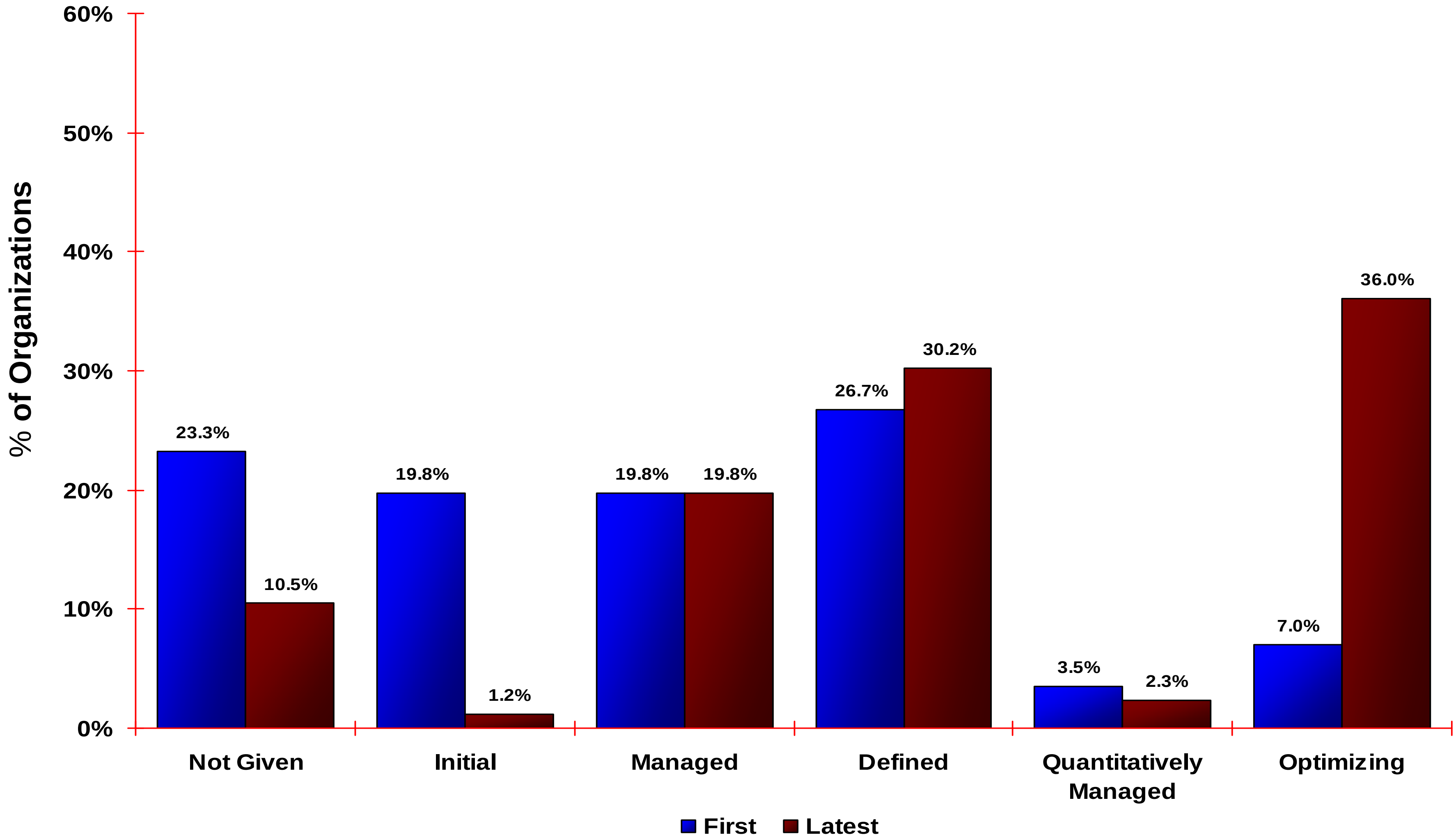
Maturity Profile by All Reporting Organizations



Based on most recent appraisal of **878** organizations

9/30/05

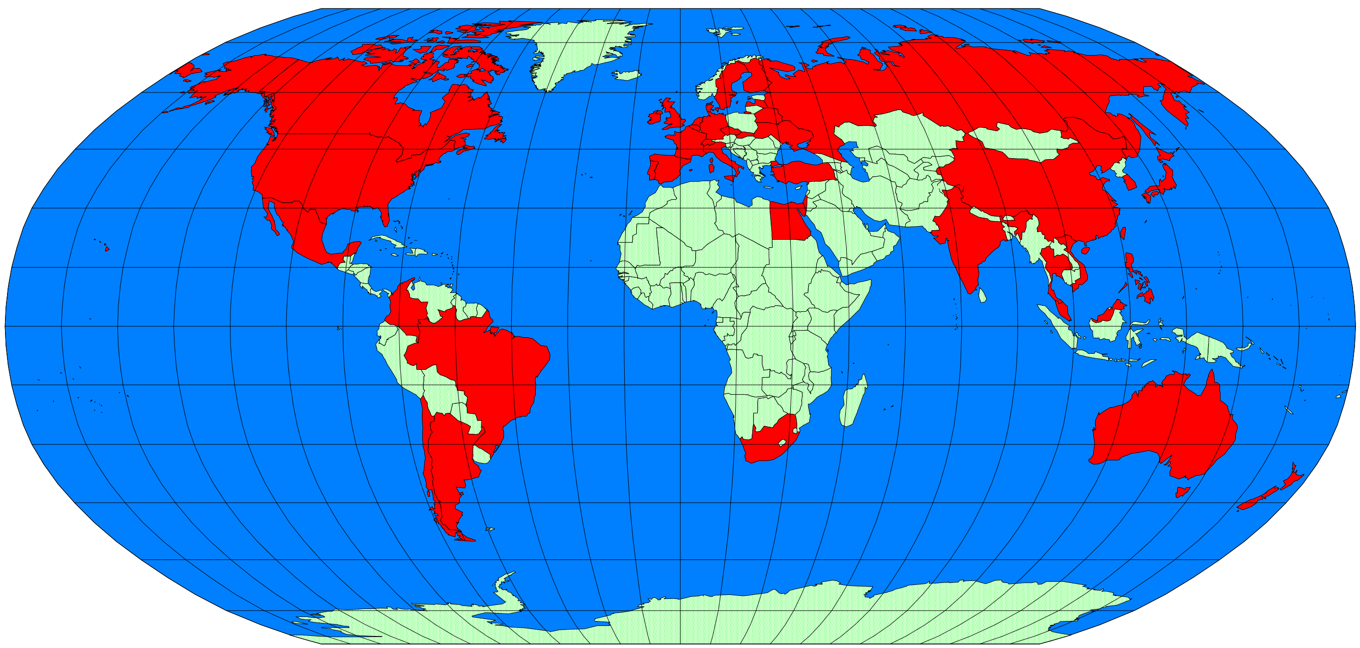
Maturity Level of First and Latest Appraisal



Based on **86** reappraised organizations using their first and latest appraisal

9/30/05

Countries Where Appraisals Have Been Performed and Reported to the SEI

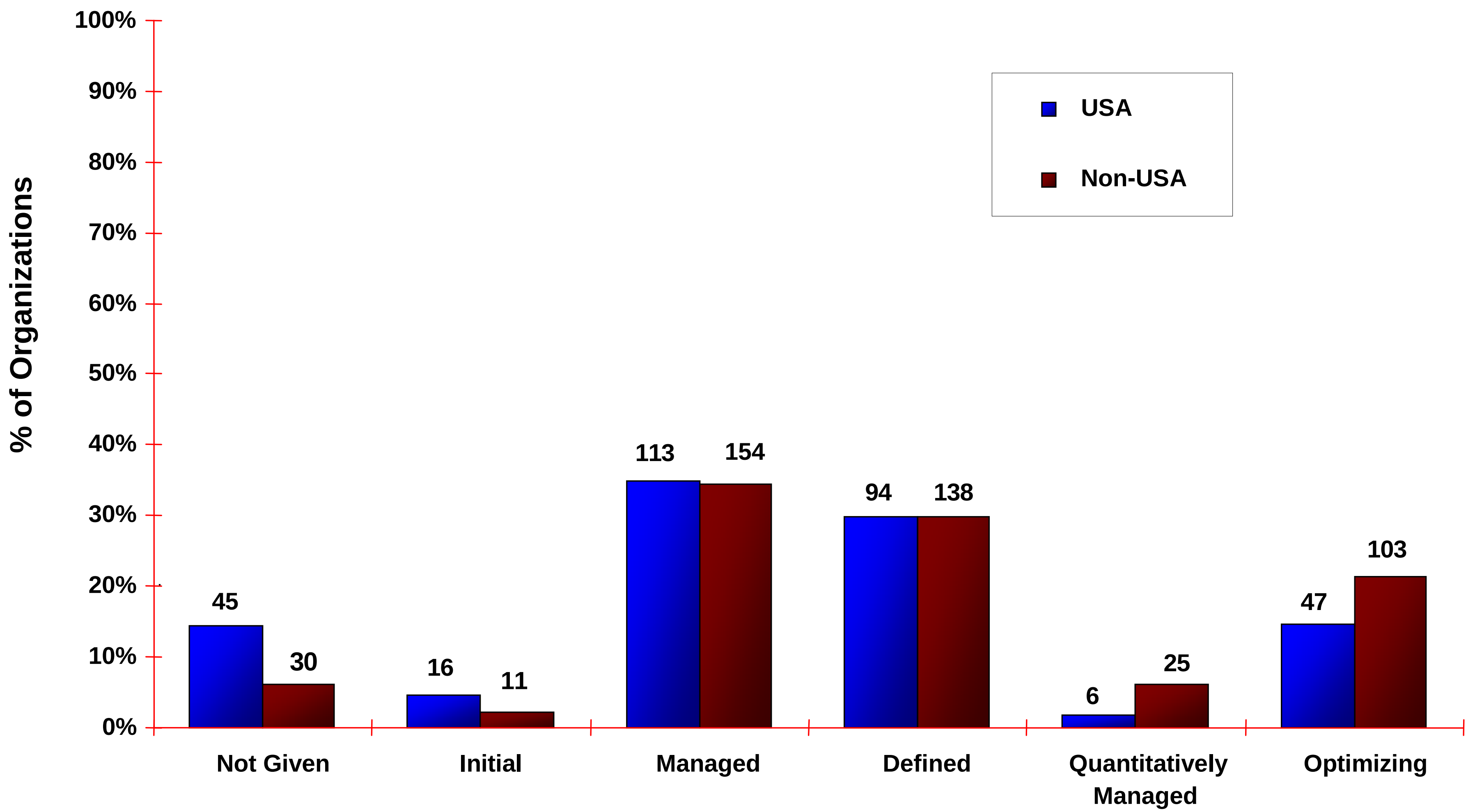


Argentina	Australia	Belarus	Belgium	Brazil	Canada	Chile
China	Colombia	Czech Republic	Denmark	Egypt	Finland	France
Germany	Hong Kong	India	Ireland	Israel	Italy	Japan
Korea, Republic of	Latvia	Malaysia	Mexico	Netherlands	New Zealand	Philippines
Portugal	Russia	Singapore	Slovakia	South Africa	Spain	Sweden
Switzerland	Taiwan	Thailand	Turkey	Ukraine	United Kingdom	United States
Vietnam						

Purple country name: new additions with this reporting since Nov. 2004

9/30/05

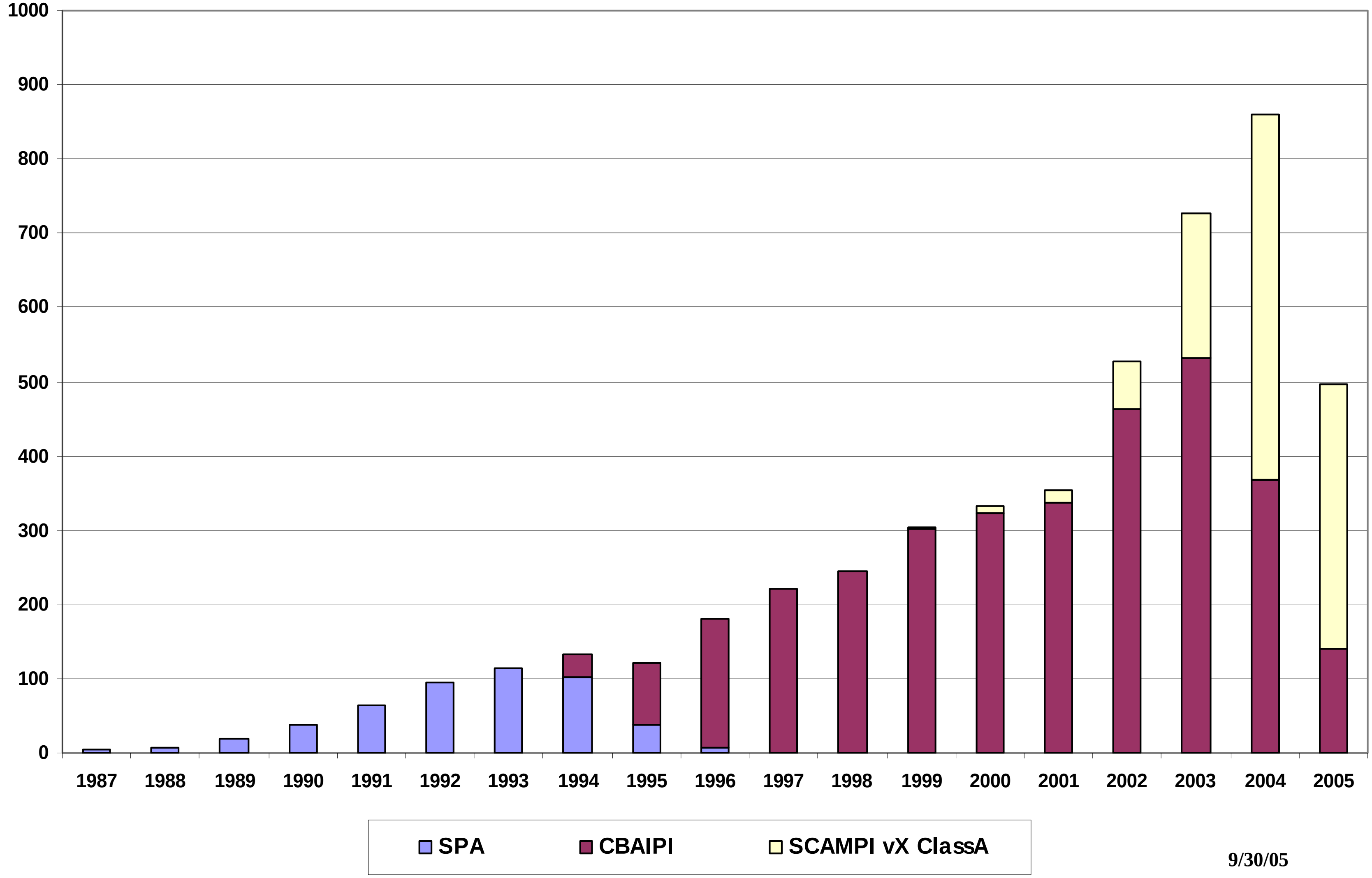
Maturity Profile by All Reporting USA and Non-USA Organizations



Based on **355** USA organizations and **523** Non-USA organizations

9/30/05

Number of Appraisals Conducted by Year



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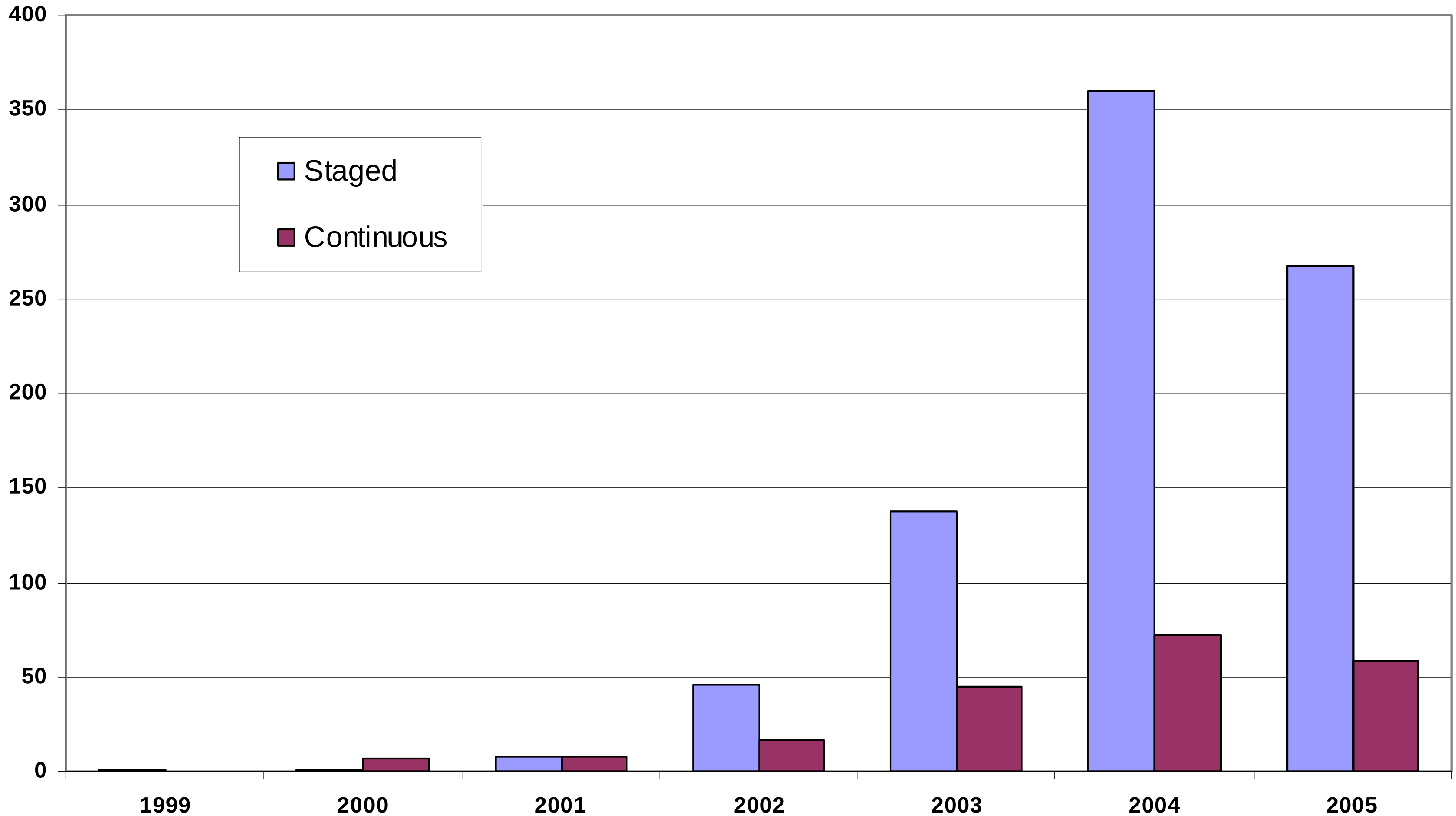
Number of SCAMPI Version x.x Class A Appraisals

Conducted by Year by Model Representation (where representation is reported)



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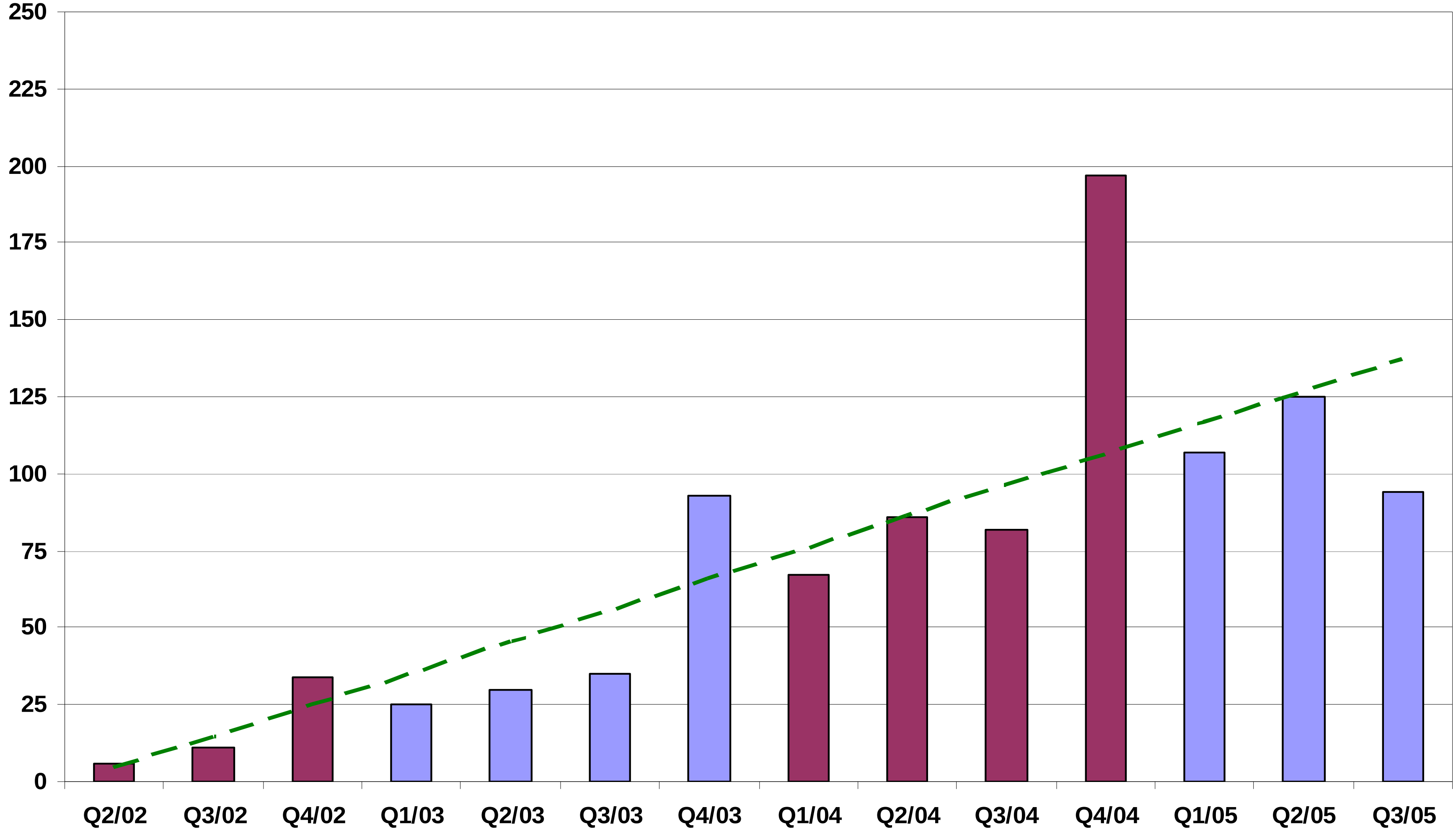
Number of SCAMPI Version 1.1 Class A Appraisals Conducted by Quarter



9/30/05

Appraisal Results Summary

977 appraisals have been reported since the April 2002 SCAMPI Class A Version 1.1 release.

Commercial/In-House organizations reporting appraisals is increasing more rapidly than other organizational categories.

Government/Military and Government/Military Contractors reporting appraisals is increasing at a stable and consistent rate.

The highest percentage of Commercial/In-House organizations reporting appraisals is from outside the USA.

The highest percentage of Government/Military Contractors reporting appraisals is from the USA.

Comparing early reports of the SW-CMM maturity profile with early CMMI data reflects a more mature CMMI profile.

Additional information and charts will be released as more appraisals are reported and more data is available to support the breakdowns.

Topics

Appraisal Results

➡ Transition Status

Product Suite V1.2 Update

Summary

CMMI Transition Status – 9/30/05 1

<u>Training</u>

- Introduction to CMMI – 38,891 trained
- Intermediate CMMI – 1,738 trained
- Introduction to CMMI Instructors – 372
- SCAMPI Lead Appraisers – 577 trained

<u>Authorized</u>

- Introduction to CMMI V1.1 Instructors – 290
- SCAMPI V1.1 Lead Appraisers – 398

CMMI Transition Status – 9/30/05 2

Transition partnering

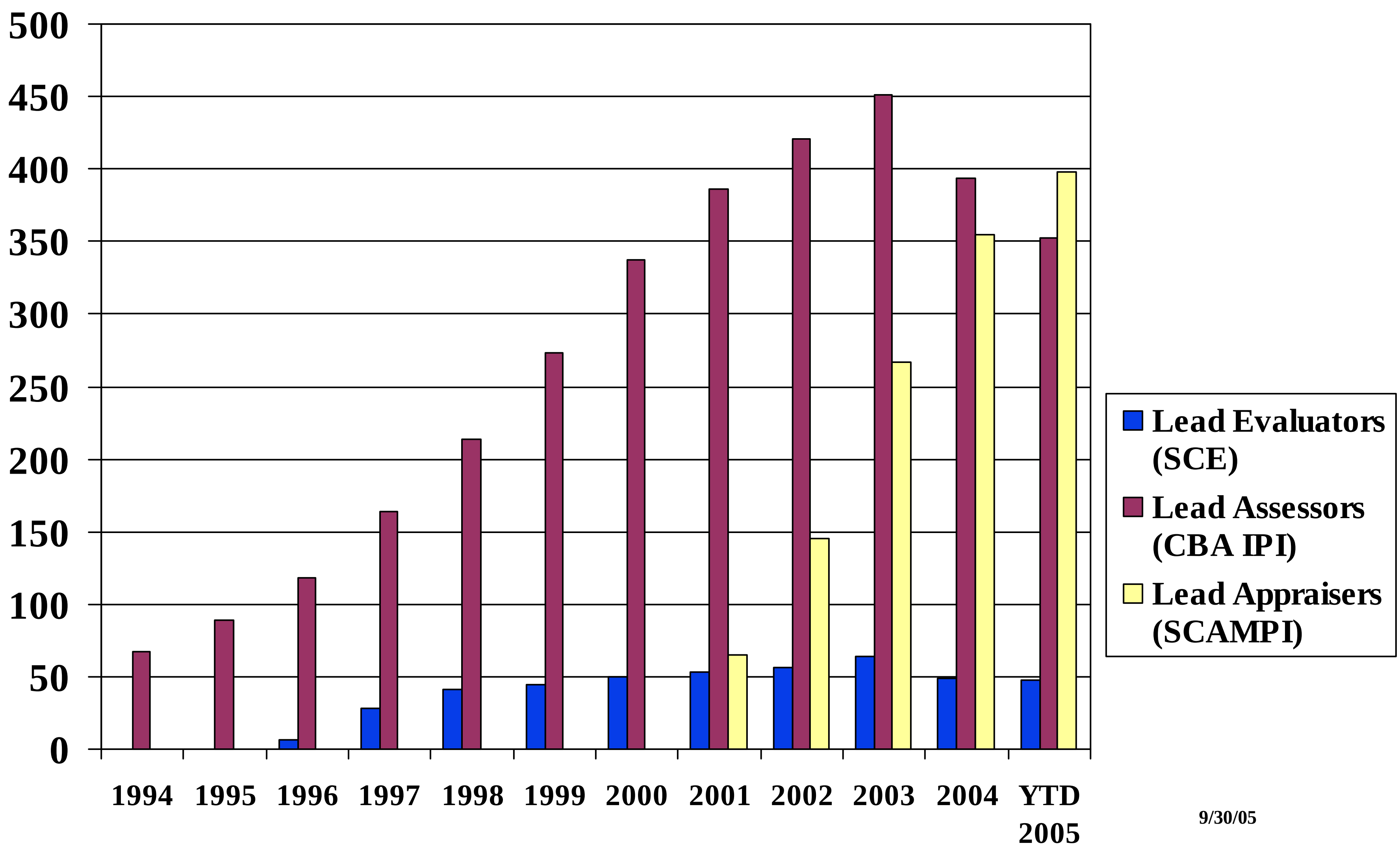
Introduction to CMMI

- 190 have signed
  - 172 are commercial offerors only
  - 14 are internal-use only
  - 4 government-use only

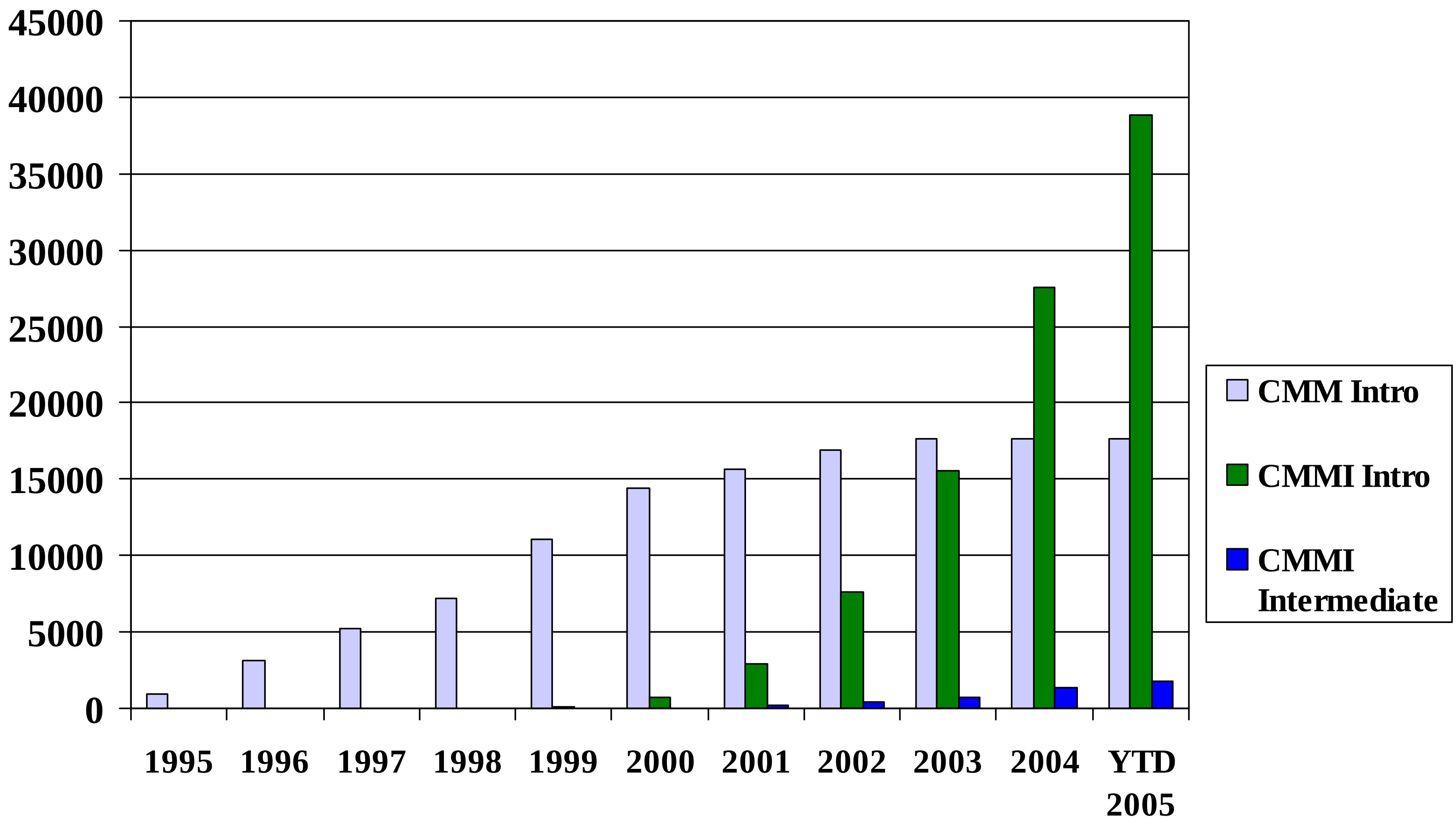
SCAMPI Appraiser Services

- 213 have signed
  - 193 commercial offerors only
  - 14 are internal-use only
  - 6 government-use only

Number of Lead Appraisers Authorized (Cumulative)

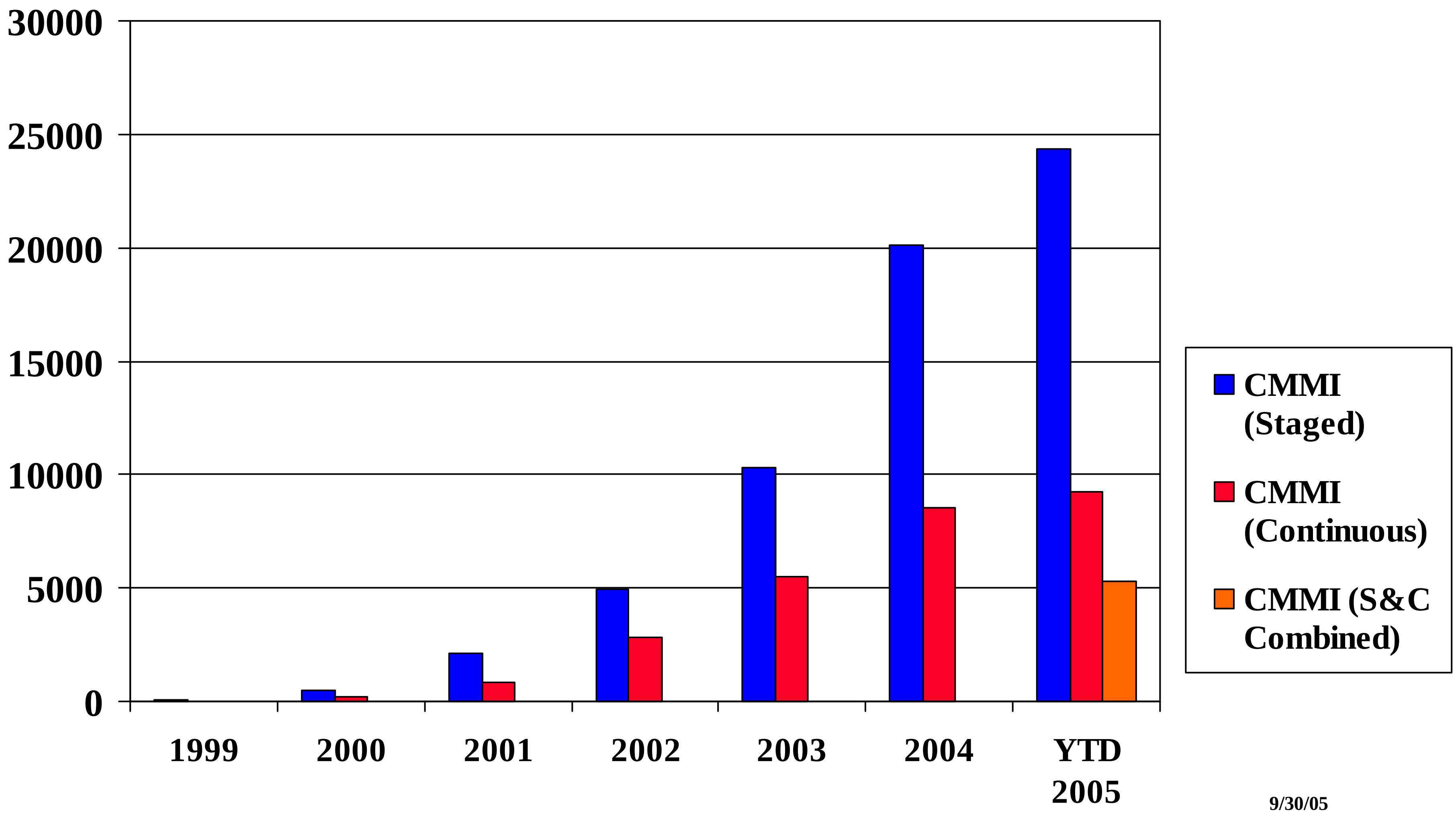


Intro to the CMM and CMMI Attendees (Cumulative)



9/30/05

Number of CMMI Students Trained (Cumulative) as of 9/30/05



9/30/05

CMMI Adoption Trends: Website Visits [1]

CMMI web pages hits

- 1.8M/month
- Exceeded 60K/day in August 2005

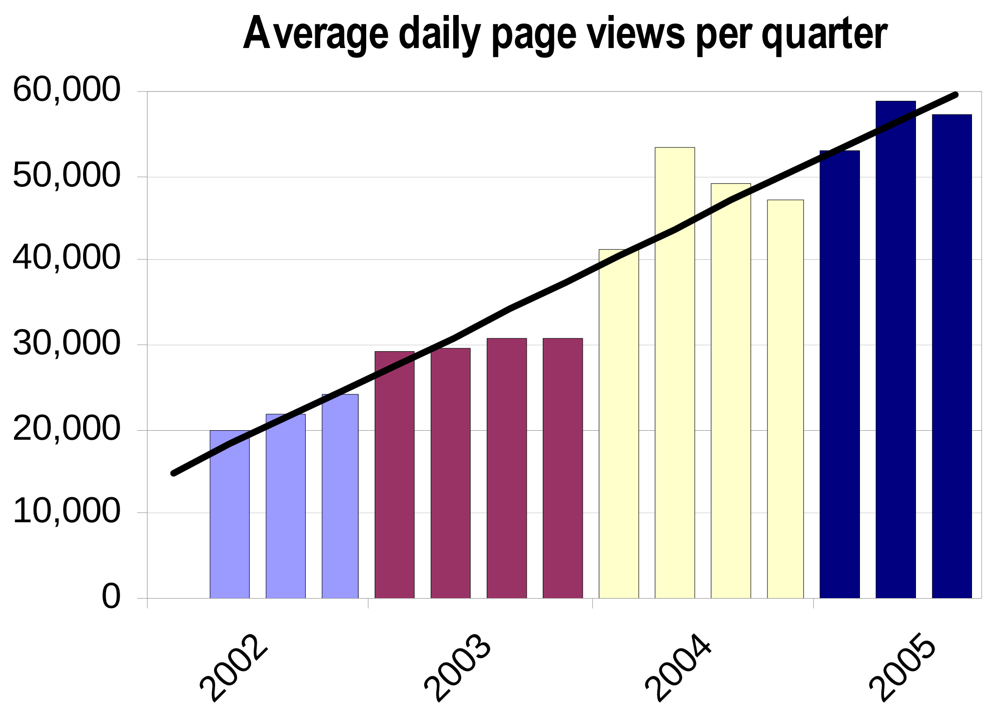
443 organizations visited the CMMI Website more than 200 times during September 2005:

- 29 Defense contractor organizations
- 12 DoD organizations
- 49 Universities
- 328 Commercial companies
- 25 Non-DoD government agencies

CMMI Adoption Trends: Website Visits 2

The following were the top viewed pages on the CMMI Website in September 2005:

- CMMI Main Page
- What is CMMI?
- CMMI Models and Modules
- Getting Started with CMMI Adoption
- CMMI Training, Events, & Forums



Performance Results Summary 1

Improvements	Median	# of data points	Low	High
Cost	20%	21	3%	87%
Schedule	37%	19	2%	90%
Productivity	67%	16	11%	255%
Quality	50%	18	29%	132%
Customer Satisfaction	14%	6	-4%	55%
Return on Investment	4.8 : 1	14	2 : 1	27.7 : 1

- N = 24, as of 9 November 2005
- Organizations with results expressed as change over time

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Performance Results Summary 2

Credible quantitative evidence
(http://www.sei.cmu.edu/cmmi/results.html)

- 28 separate organizations as of November 2005
- Major Website update for CMMI Technology Conference in November 2005
  - Almost 50% more data points in the new table
  - Update includes a few results where new evidence has become available since March 2005
- Initial CMMI benefits and ROI report, October 2003
- Forthcoming TR
- Frequent presentations and tutorials
  - CMMI Technology, SEPG, ESEPG, etc.

Sources

- Conference presentations
- Published papers
- Direct communication with the SEI
- Future results from
  - case vignettes, case studies, community benchmarking

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STRENGTH THROUGH INDUSTRY & TECHNOLOGY

Topics

- Appraisal Results
- Transition Status
- ➡ Product Suite V1.2 Update
- Summary

CMMI Version 1.2 Plan

"Single book, single course" strategy begun

- V1.2, like the Addison-Wesley book, will consolidate both staged and continuous representations
- Single course for "Intro to CMMI" has been created
  - 1st offering April 2005
  - New instructors are being trained in this single course
  - Existing instructors have received upgrade training
  - Staged and Continuous courses will be sunset December 2005
- Phased SCAMPI refinements will complement strategy
- Pilot the proposed V1.2 changes from Dec 05 - Feb 06
- Release V1.2 Summer 2006
- Sunset V1.1 after a suitable transition period
- Provide V1.2 upgrade training to V1.1 users

Version 1.2 Changes 1

- Eliminate concept of advanced practices and common features
- Integrate ISM into SAM at Level 2
  - Eliminates SS (supplier sourcing) option
- Recognize, given hardware additions, that providing separate development model designations no longer useful
  - i.e. “CMMI-SE/SW”, “CMMI-SW”
  - “single book” approach (CMMI-DEV+IPPD)
- “Not applicable” process areas (PAs) for maturity levels no longer an option except for SAM

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Version 1.2 Changes $_2$

- Clarify material based on 1000+ Change Requests (e.g., improve high maturity verbiage)
- Work environment material added to OPD and IPM
- Glossary improved (e.g., higher level management, bidirectional traceability, subprocess)
- Overview text improved
- IPPD coverage consolidated and simplified

Integrated Product and Process Development (IPPD) Changes

IPPD material is being revised significantly.

- **Organization Environment for Integration PA removed and material moved to Organizational Process Definition (OPD) PA.**
- **Integrated Teaming PA removed and material moved to Integrated Project Management (IPM) PA.**
- **IPPD goals in the IPM PA have been consolidated.**
  - **apply IPPD Principles**
  - **reflects the revised content**
- **Overall material condensed and revised to be more consistent with other PAs.**

SCAMPI A Changes Being Considered for V1.2

Method implementation clarifications

- interviews in “virtual” organizations
- practice characterization rules
- organizational unit sampling

Appraisal Disclosure Statement (ADS) improvements

- Add clarifying content to better describe organizational and project scope and coverage
- reduce redundancy with other appraisal documents
- improve usability for sponsor and government
- require sponsor’s signature on the ADS

Establish maturity level and capability level “shelf life” – 3 years

CMMI “Shelf Life” or expiration date

V1.1 appraisals will be valid for <u>three years</u> from the time of completion, or one year after V1.2 release, whichever is longer.

- V1.1 appraisal results must be reported within nine months of appraisal completion.
- V1.1 appraisals will be accepted as valid through December 2007.
- Any appraisal using either the V1.1 model or the V1.1 method is considered a V1.1 appraisal.
- The SEI will provide notification of appraisal age at the two year point.

Beyond V1.2 1

Improved architecture will allow post-V1.2 expansion.

- **Extensions of the life cycle (Services, Acquisition & Outsourcing) could expand use of a common organizational framework:**
  - **allows coverage of more of the enterprise or potential partnering organizations**
  - **adapts model features to fit non-developmental efforts (e.g., CMMI Services, CMMI Acquisition)**
- **Created concept of CMMI "constellations" to accommodate the expansion**

Beyond V1.2 $_2$

First two constellations, CMMI Services and CMMI Acquisition, have been authorized by CMMI Steering Group. Development will be in parallel with V1.2 effort; publication sequenced after V1.2 rollout.

Northrop-Grumman is leading industry group for CMMI Services.

- Initial focus will be for organizations providing “DoD services” as well as internal IT:
  - e.g. aircraft maintenance
  - Network Management, IT Services
  - IV&V

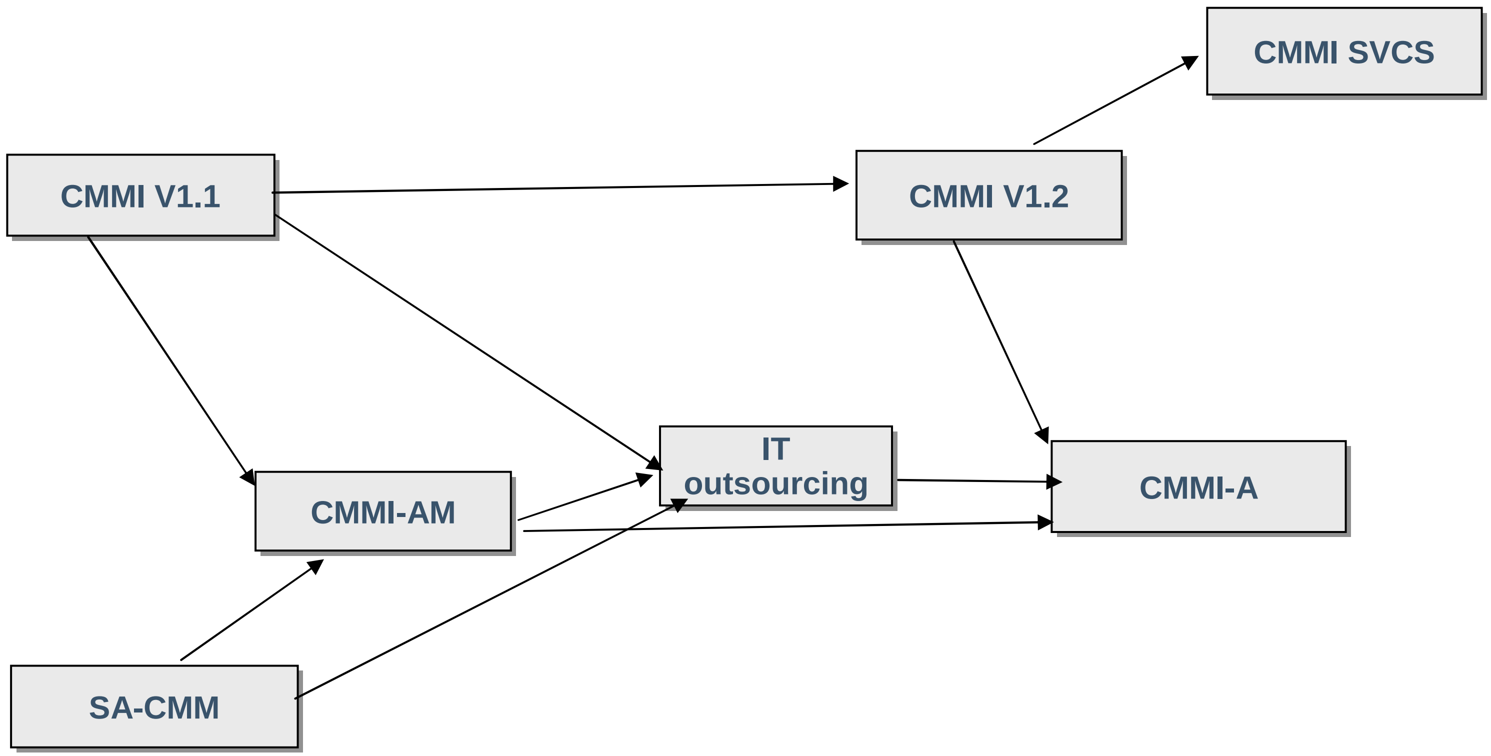
NATIONAL DEFENSE INDUSTRIAL ASSOCIATION
STRENGTH THROUGH INDUSTRY & TECHNOLOGY

Beyond V1.2 $_3$

SEI is coordinating requirements elicitation for CMMI Acquisition.

- **Collecting government needs and perspectives from both DoD and civil agencies**
- **Will build upon existing CMMI Acquisition Module (CMMI-AM) plus an initial effort to develop an IT outsourcing model (also based on CMMI-AM)**

Planned Sequence of Models



STRENGTH THROUGH INDUSTRY & TECHNOLOGY

Topics

Appraisal Results

Transition Status

Product Suite V1.2 Update

➡ Summary

Summary

Close to 1000 appraisals have been reported since the SCAMPI Class A Version 1.1 release.

CMMI continues to experience world-wide adoption.

- At this time, approximately 40,000 people will have taken the Introduction to CMMI course
- Appraisals reported in 13 countries for the first time

CMMI V1.2 is nearing the piloting phase and will be available in the upcoming year.

CMMI constellations have been commissioned by the CMMI Steering Group.

NORTHROP GRUMMAN

DEFINING THE FUTURE

CMMI: Does it Help Us Perform?

CMMI Technology Conference, Denver, CO

November 15th, 2005

Gary Salisbury

Vice President, Business Development and Sales

Mission Systems Sector, Defense Mission Systems Division
Northrop Grumman Corporation

Mission Systems Sector

- **A leading integrator of complex, mission-enabling systems**
- **2004 Sales - ~$5.0B**
- **18,500 employees in 50 states and in 23 countries**
- **1500 active contracts**
- **Domain expertise in priority, high-growth segments**
- **Premier provider of mission critical end-to-end solutions**

Focused on program performance

Does CMMI Help Programs Perform?

- **CMMI is necessary but, alone, is not sufficient**
- **Programs must also have**
  - Management and Customer commitment
  - Reasonable and stable requirements
  - Adequate and trained, talented resources
  - Experienced organizations with domain knowledge
- **BUT …**
  - Even with all of these, program organizations don't have the time to invent best practices
  - Employment of good process is essential to success
- **AND …**
  - Using CMMI is the best means we've found to repeatedly deploy our best processes and practices to new programs

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What We Have Learned - It's Not What You Do, But When You Do It!

- **Programs need to apply key basic processes early (even prior to award)**
  - Integrated Project Management (IPM)
  - Program Planning (PP)
  - Program Monitoring and Control (PPMC)
  - Risk Management (RSKM)
  - Requirements Management (RM) and Requirements Development (RD)
  - Measurement and Analysis
  - Decision Analysis and Resolution
- **Good processes enhance good decision making**
- **Builds the discipline needed for success under 'start up stress'**

We concentrate on putting proven processes in place before program kick off!

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Mission Systems Emphasizes ‘Early Start’

These processes are mandatory although they can be tailored or waived as to the unique circumstances of each particular program

- **Process / Waiver Checklist**
  - Every project is required to identify the processes that it will adopt and which it intends to request to be waived – **during the proposal phase**
- **Project kick off**
  - Every project is required to report on its adoption of process and progress towards execution in a kick-off Process Review
- **Project Process CMMI Guidance**
  - Every project is provided with guidelines on which process areas should be in place early and what activities should be included

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Does It Work?

- **Post award SCAMPI Bs**
  - Successfully demonstrates that programs were operating at expected maturity within 6 months of project kick off
    - Naturally, some work products that are created later in the project life cycle won't be available
  - Two SCAMPI Bs in the last few months demonstrate our early process focus results in executing Mission Systems processes from start up
- **Internal SCAMPI C appraisals ensure projects are ready before we formally appraise them for public release**
- **Use of PIIDs "on-line" has made electronic verification of process deployment simple and effective in a multi-site organization**

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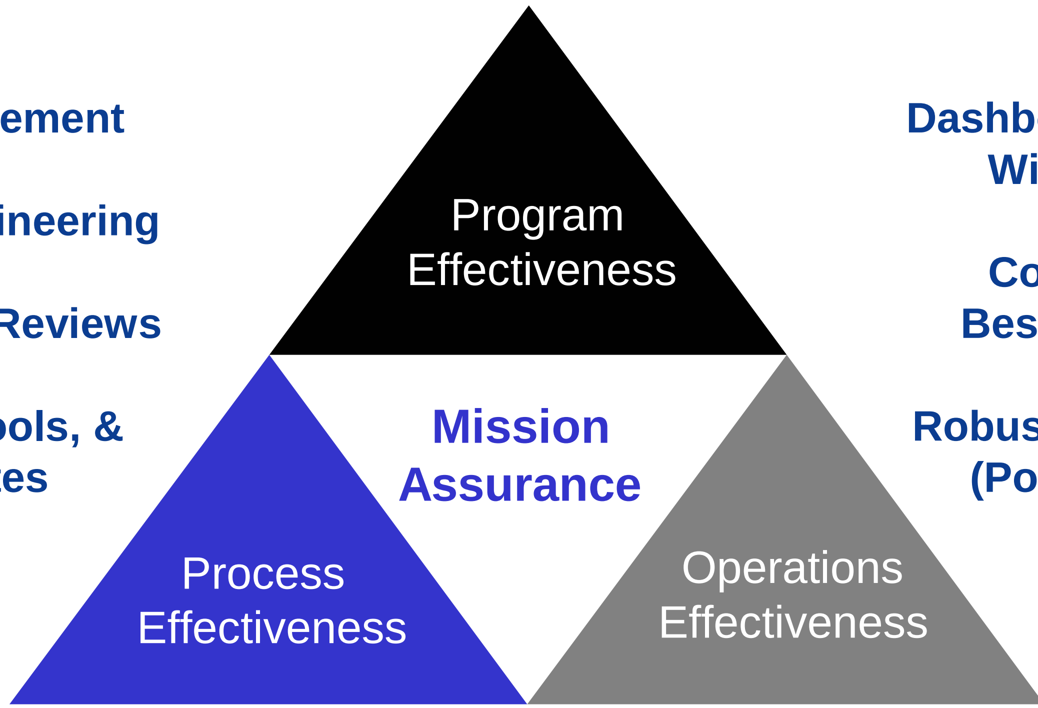
Mission Success Requires Multiple Approaches

Risk Management

Systems Engineering

Independent Reviews

Training, Tools, & Templates



Dashboards for Enterprise-Wide Measurement

Communications & Best-Practice Sharing

Robust Governance Model (Policies, Processes, Procedures)

CMMI Level 5 for Software, Systems, and Services

ISO 9001 and AS-9100 Certification

Six Sigma

NORTHROP GRUMMAN

Early Starts Result in Proven Maturity

- **Mission Systems has made a major investment in process improvement**
- **We believe that our emphasis on early start is a large contributor to these results**

Organization	Level 5	Level 4	Level 3	Level 2	Total
Northrop Grumman	16*	-	8	-	24
▪ Mission Systems	11*	-	3	-	14
U.S. Government	2	-	-	12	14
▪ DoD	2	-	-	7	9
Raytheon	3	1	10	-	14
IBM (International)	6	1	6	-	13
SAIC	5	-	4	3	12
Lockheed Martin	2	3	6	-	11

Source: Software Engineering Institute Publicly Reported CMMI Appraisals website
- http://seir.sei.cmu.edu/pars/pars_list_iframe.asp

* 4 other appraisals not yet listed

NORTHROP GRUMMAN

DoD and CMMI

November 15, 2005

Mark Schaeffer
Principal Deputy, Defense Systems
Director, Systems Engineering

CMMI Vision

The initial vision for CMMI was to integrate the competing maturity models and provide a framework for more consistent process improvement

- Cause integration of the functional disciplines within organizations and across programs
- Increase systems engineering process maturity as organizations migrate from the sun-setting CMMs to CMMI

Build on and improve the significant work done on CMM-like models

Have We Lost Sight of the Goal?

- The end goal of CMMI is to provide a model for continuous process improvement to achieve:
  - Reduced cycle times
  - Meet cost and schedule targets
  - Improved quality
  - Combining Systems Engineering and Software into a common model

When achieving a level replaces the focus on continuous improvement, we've lost sight of the goal

How We Got Where We Are

- CMMI Sponsors opted to pursue staged and continuous models to preserve legacy
  - SW-CMM, staged
  - SECM, continuous
- Acquiring organizations do not have full understanding of how CMMI is intended to be used
  - What a specific level at the enterprise level actually means to an acquisition program
  - That the process and people evaluated to obtain a level are not necessarily applied to their program
  - Achievement of a specific level may or may not have meaning to any given acquisition program

Negative Effects of “Levels”

- Organizations often focus on maturity levels vice continuous improvement
- Organizations are tempted to view CMMI Level “X” as an “end” rather than a “means to the end”
- Some organizations may stop at Level “X” because that is all that is required or expected
- Level “X” companies often do not perform at that level on all programs—not all programs are appraised
- Once an organization achieves a desired level, the tendency is to let the baseline erode—can result in reduced ROI

DoD expects that if you have achieved high maturity, the next program will perform at that maturity

CMMI Workshop, Sept 7&8, 2005

- The workshop addressed several significant aspects of utilizing CMMI in the DoD and federal acquisition process that have been troublesome, and developed recommendations that the CMMI Steering Group, and DoD or federal acquisition agencies can address. Some issues that were discussed include:
  - Background on how organizations approach CMMI appraisals and why
  - Use of Appraisal Disclosure Statement by acquiring organizations
  - Formal guide to CMMI Usage for DoD
  - Training for DoD Acquisition Organizations in the use of CMMI for DoD
  - Government lack of understanding of need for mature SE content and practice
  - Specifying or requiring CMMI in RFPs
  - CMMI Appraisal expiration date

Workshop Findings

- Programs execute at lower maturity levels than their organizations have achieved and advertised
- Appraisals use small samples—don't cover all projects
- You can't judge a program without appraising it
- How can an organization's level be for "Life" when people and processes change?
- High-maturity practices are not consistently applied at the project level after contract award
- Is the completeness of appraisal disclosure statements adequate?
- Low-maturity acquirers and high-maturity suppliers

Sound Familiar?

Potential Root Causes

- Lack of sufficient CMMI guidance for acquisition professional—what it can do, what it cannot do, applicability to source selections?
- Lack of tailored education and training for acquisition professionals—program managers and contract officers
- Vagueness with respect to what an CMMI level actually means

Way Ahead

- Develop relevant guidance focused on multiple user needs
- Educate the Acquisition Community
- Eliminate “Level for Life”

Continue to improve the “application” of CMMI

Raytheon
Customer Success Is Our Mission

Defect Data & Configuration Management

NDIA/CMMI Conference

Julie Schmarje

Raytheon Corp.

November 15, 2005

CMMI®

Topics

- Defects and the CMMI
- Defect Collection and Reporting Process Flow
- CM Role in Defect Collection
- Issues in CM Defect Data Collection
- Summary

Introduction

- **Raytheon Space and Airborne Systems (SAS)**
  - 13,000 + employees
  - Achieved
    - CMMI Level 5, Software Engineering, Sept. 2003, PSAS (Texas)
    - CMMI Level 3, Systems Engineering, Software Engineering, and Hardware Engineering, August 2005 (California and Texas)
      - ~ 6500 employees
      - 6 Appraisal Programs
      - Over 7800 artifacts collected
      - Appraisals Conducted
        - 2 - Class C (February, July 2005)
        - 3 - Class B (April, 2004, November 2004, May 2005)
        - 1 - SCAMPI (August 2005)

Common Terms

- **Defect: *(n.)* Want or absence of something necessary for completeness or perfection; deficiency; *(n.)* Failing; fault; imperfection**
- **The following terms are used in a generic manner:**
  - Baseline – An approved work product at a specific revision/version and date. A baselined work product is one that is released and controlled by CM.
  - Change Request (CR) –The CR on programs could be the IR/CN, PDM Work Auth, SCR, SCN, STN, etc.
  - Configuration Control Board (CCB) – The board that reviews and dispositions CRs against baselined work products. The CCB on programs that perform this function could be called any one of a number of names – ERB, CRB, SCCB, CCB, PRB, etc.

What is a defect and why be concerned?

Defects and the CMMI (1)

- **In a CMMI-compliant Organization Standard Process (OSP), defects are typically**
  - identified in product reviews and audits as described in the Verification Process Area (PA) (Level 3),
  - analyzed and used as described in the Organizational Process Performance and Quantitative Project Management PAs (Leve
  - and used to perform root cause analysis to prevent similar def future from being introduced as described in the Causal Analy Resolution PA (Level 5).

Identifying, using, and preventing defects

Defects and the CMMI (2)

- For Engineering, the purpose of identifying and categorizing defects in selected work products is to find and remove defects early in its lifecycle.
- Studies have shown that the later a defect is identified in a work product's life cycle, the more damage it causes, and the more costly it is to remove.

What is a defect and why be concerned?

Defects and the CMMI (3)

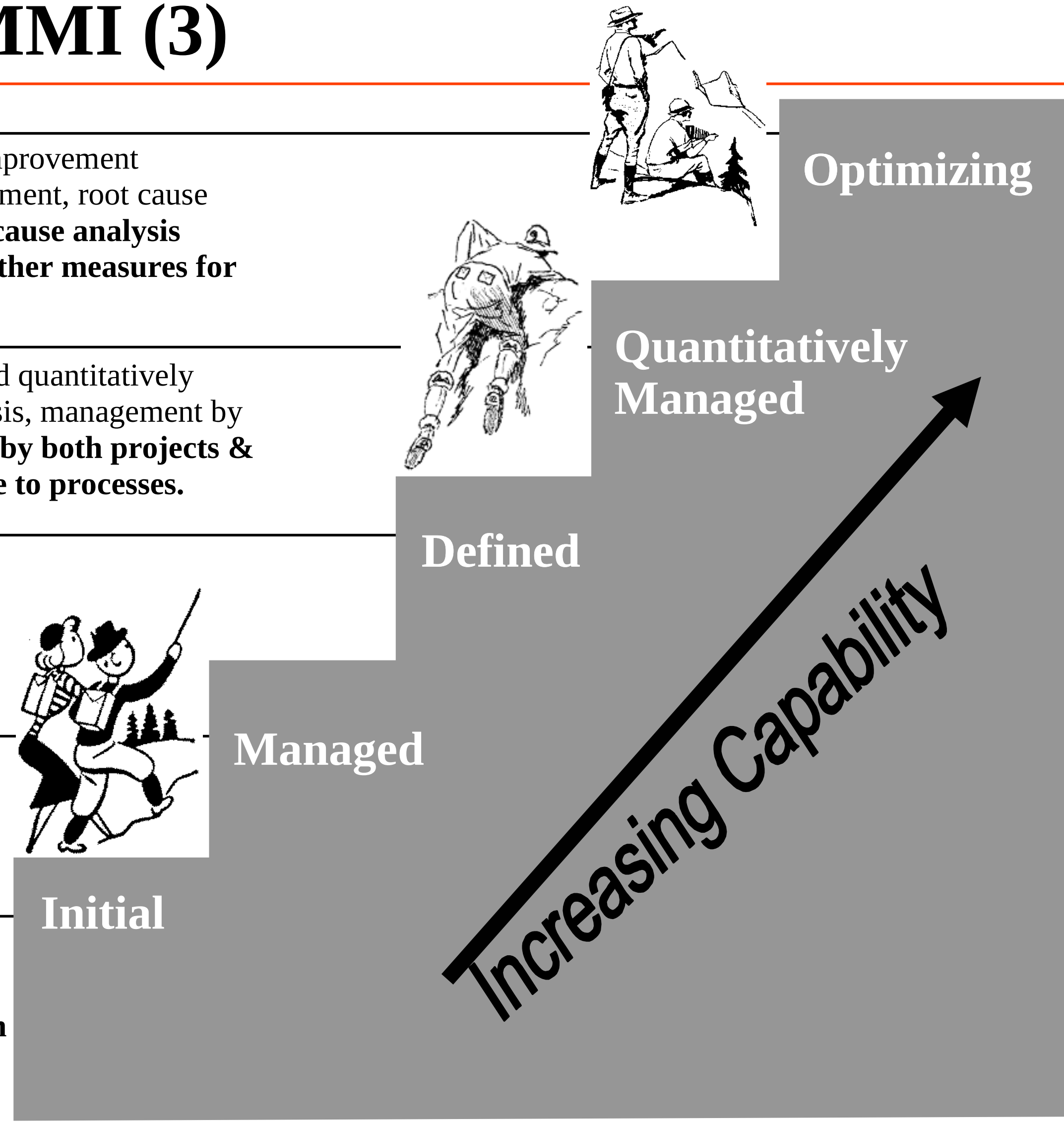
5 Focus on continuous process improvement (the science of process improvement, root cause analysis, ROI, piloting). **Root cause analysis performed on defect data & other measures for prevention of future defects.**

4 Process measured and controlled quantitatively (control charts, statistical analysis, management by data). **Defect data is analyzed by both projects & the org. Corrections are made to processes.**

3 Process characterized for the **organization** and is proactive. **Peer Reviews occur & defect data reported at org & project level.**

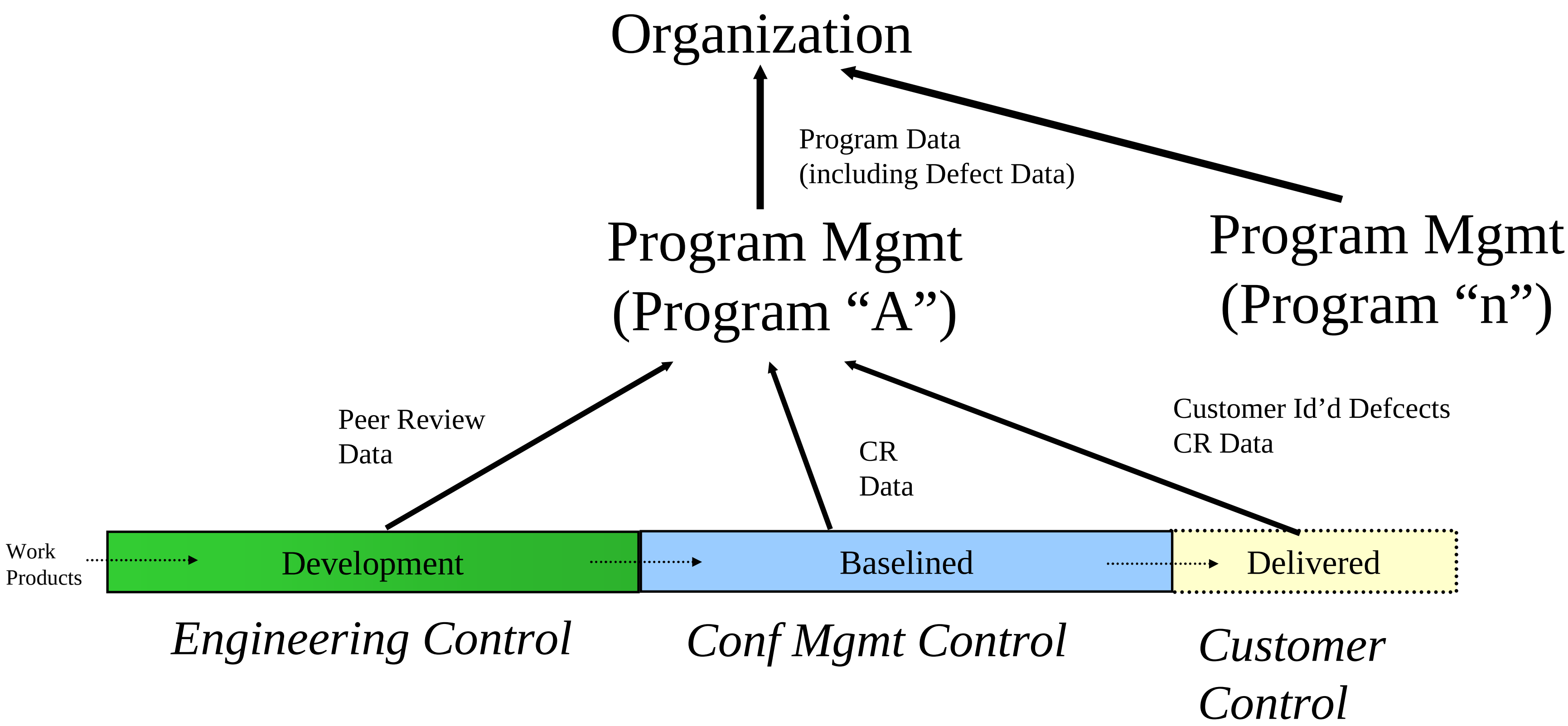
2 Process characterized for **projects** and is often reactive. **Measures defined & collected by projects.**

1 Process unpredictable, poorly controlled & reactive. **Defects only identified and removed in later lifecycle phases.**



The emphasis on defect data increases with maturity.

Defect Data Collection & Reporting Process Flow



Defect Data is collected from Peer Reviews & CM

Engineering Control

- **During development, a work product is typically under Engineering Control.**
- **When ready, the work product is Peer Reviewed, defects identified, and categorized including:**
  - Type of defect found
  - Phase where defect was injected
  - Phase where defect was found
- **The defect data is collected and reported to Program Management.**
- **This process is part of the CMMI Verification Process Area (PA).**

Peer Reviews provide defect data for work products under Engineering Control.

CM Control (1)

- **Once the work product has been Peer Reviewed and ready to be controlled, it is given to CM for baseline (release).**
- **Once released, the Change Management process begins.**
  - To change a released work product, the appropriate Change Requests (CRs) are initiated and evaluated by a Configuration Control Board (CCB).
  - The CCB analyzes (or facilitates the analysis of) the change and, if determined to be a valid change, the defect is identified and categorized on the CR.

CRs provide defect data for work products under CM Control.

CM Control (2)

- CM collects and provides the change and defect data to Program Management.
- This process is part of the CMMI CM Process Area (PA).

CRs provide defect data for work products under CM Control.

Customer Control

- **Once work products are delivered, defects found are communicated back to the organization by the customer. This communication takes the form agreed upon by the customer and the program.**
  - A CR is written documenting the defect found by the customer.
  - Since the work product has been released prior to customer delivery, the CR follows the same Change Management process described under CM Control.
- **CM collects and provides the customer change and defect data to Program Management.**
- **This process is part of the CMMI CM Process Area (PA).**

CRs provide defect data found by the customer on delivered work products.

CMDM Role in Defect Data Collection

- **During program startup, CM defines:**
  - the work products to be placed under CM Control and when that control is triggered.
  - the Change Management process to be used on the program (including the type of CRs to use, the data collected on them (fields), and the CR lifecycle).
- **Once a work product is given to CM for release (baseline), CM ensures that the Change Management process is followed for any changes.**
- **When taking a CR (against a released work product) through its lifecycle, CM ensures that all fields on the CR are completed, including the defect data fields.**
- **CM coordinates the capture and analysis of defects found by the customer after delivery.**

CM ensures that defect data is captured on all CRs during the Change Management process.

Issues in CM Defect Data Collection (1)

- **If defect data is not collected on CRs (the change mechanism):**
  – The only data provided to the organization will be from Peer Reviews.
  – Since the goal is to find defects as early as possible, any defects found in released work products that escaped their phase (e.g., requirements defects found in Test) will not be identified.

Defect data not captured on CRs is a lost opportunity.

Issues in CMDM Data Collection (2)

- **Issues that impact the effective identification and use of defect data include:**
  - **Programs that release their work products late in their lifecycle:**
    - May not be providing accurate defect data information to the organization.
    - May not be documenting all changes that occur in Integration and Test on CRs; therefore, the CM defect data will not be accurate.
  - **Method for documenting changes on CRs - Care must be taken on the use of CRs for documenting changes and defect data.**
    - One CR for each type of defect identified: Easier for collecting and reporting defect data. Harder for overall change management since more than one work product could be affected.
    - One CR for each work product: Easier for change management, harder for identifying and categorizing all associated defects. The CR would need to collect all instances of defects and their categories.

To get an accurate view, the appropriate CR process must be used.

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Impact of Defect Data Issues

- The organization will not get the opportunity to analyze and correct any systemic problems. Analysis performed at the organizational level will be incomplete and conclusions reached may not be valid.
- The organization will get a false picture of how effective the program is in early capture of defects.
- Levels 4 and 5 could be impacted if the organization isn't provided with all defect data. Very few defects will be identified during Test and Integration phases could raise a red flag during a CMMI appraisal.

CMMI®

Ineffective CM defect data collection methods impacts the organization.

EPGs Role in Defining the Defect Data Process

- **The organization's EPG establishes the annual process improvement objectives based on the organization's goals. If those goals include achieving a CMMI Level 3, a proactive EPG will:**
  - evaluate the process needs for Levels 3 and 4.
  - identify gaps in current processes.
  - establish supporting measurements and analysis processes through Level 3 that will easily pave the way to Level 4.
  - ensure that all sources of measurement data have a defined standard process for identifying, categorizing, and reporting (including defect data). This would include the CM Change Management process and the collection of defect data on CRs.

The EPG must ensure that mechanisms are in place to collect and report defect data from CRs.

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Summary

- **Defect data is identified in two activities:**
  - During a Peer Review of a work product
  - During the Change Management process of a released work product.
- **CM collects, maintains, and reports the defect data in CRs.**
- **Without the CM defect data, organizations will not have all the measurement data needed for:**
  - Evaluating the programs and organizations status in early capture of defects
  - Analyzing and eliminating systemic product quality issues
  - Achieving CMMI Levels 4 and 5

CMMI®

Managing Best Practices

Adapting CMMI Policies and Procedures Used in One Part of an Organization to Another

Scott Sherrill

Georgia Tech Research Institute

Overview

- Questions
- About GTRI
- CMM/CMMI at GTRI
- ELSYS Laboratory
- ITTL Laboratory
- Timeline for Implementation at ITTL
  - Prior to 2004
  - 2004 to Present
  - Future

GTRI Organizational Structure

Vice President GT
Director, GTRI
Stephen E. Cross

Deputy Director
David E. Parekh

Administration
Janice P. Rogers

Business Operations
Charles E. Brown

Strategic Initiatives
George B. Harrison

Leadership Council

Advisory Council

Fellows Council

Research Laboratories

Aerospace Transportation & Advanced Systems
James M. McMichael

Electronic Systems
William S. Rogers

Electro-Optical Systems
Gisele Bennett

Health & Environmental Systems
Jeffrey J. Sitterle
(Interim Director)

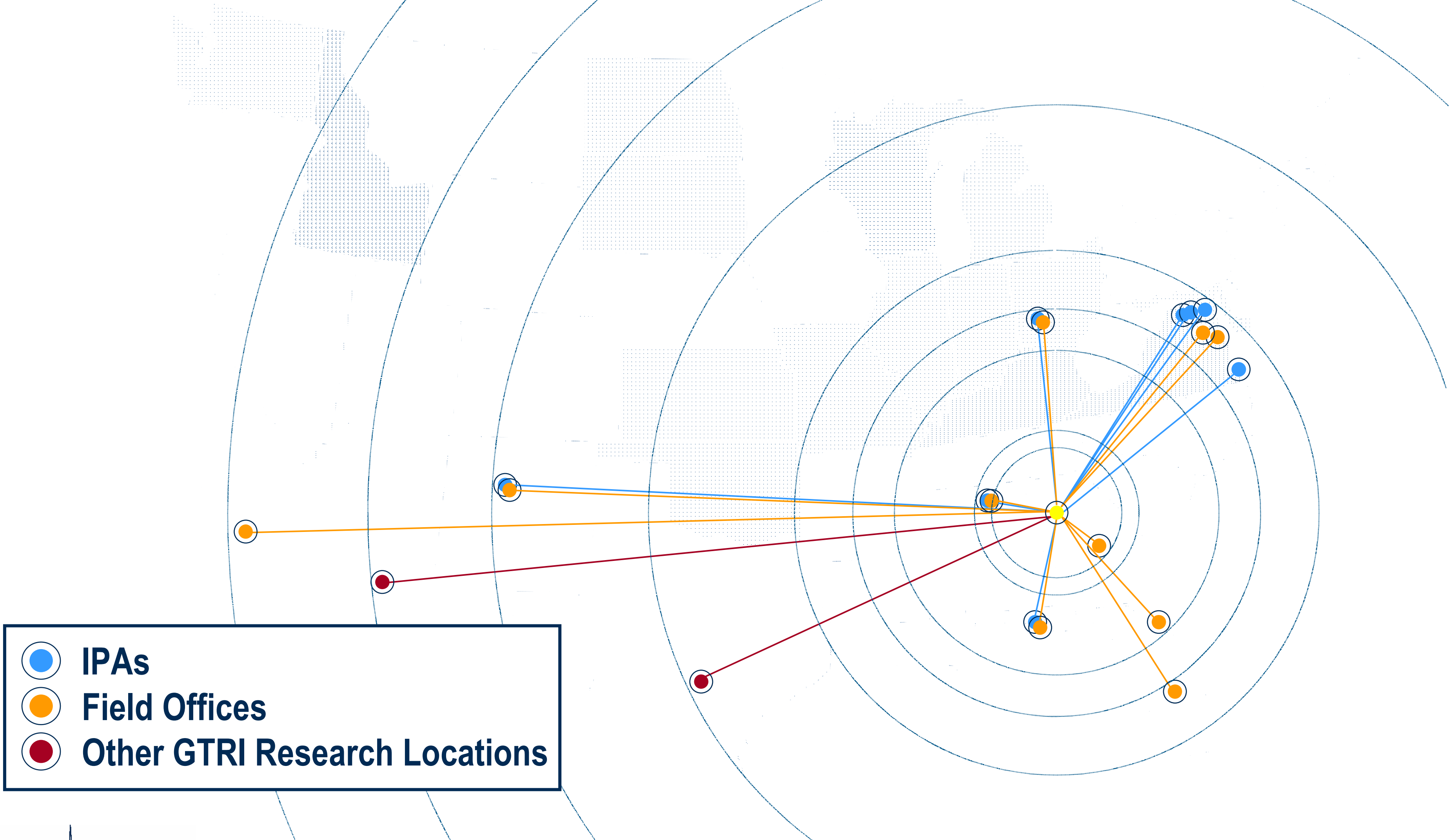
Huntsville Research
Barry D. Bullard

Information Technology & Telecommunications
Randolph M. Case

Sensors & Electromagnetic Applications
Robert N. Trebits

Signature Technology
John G. Meadors

GTRI'S National Presence



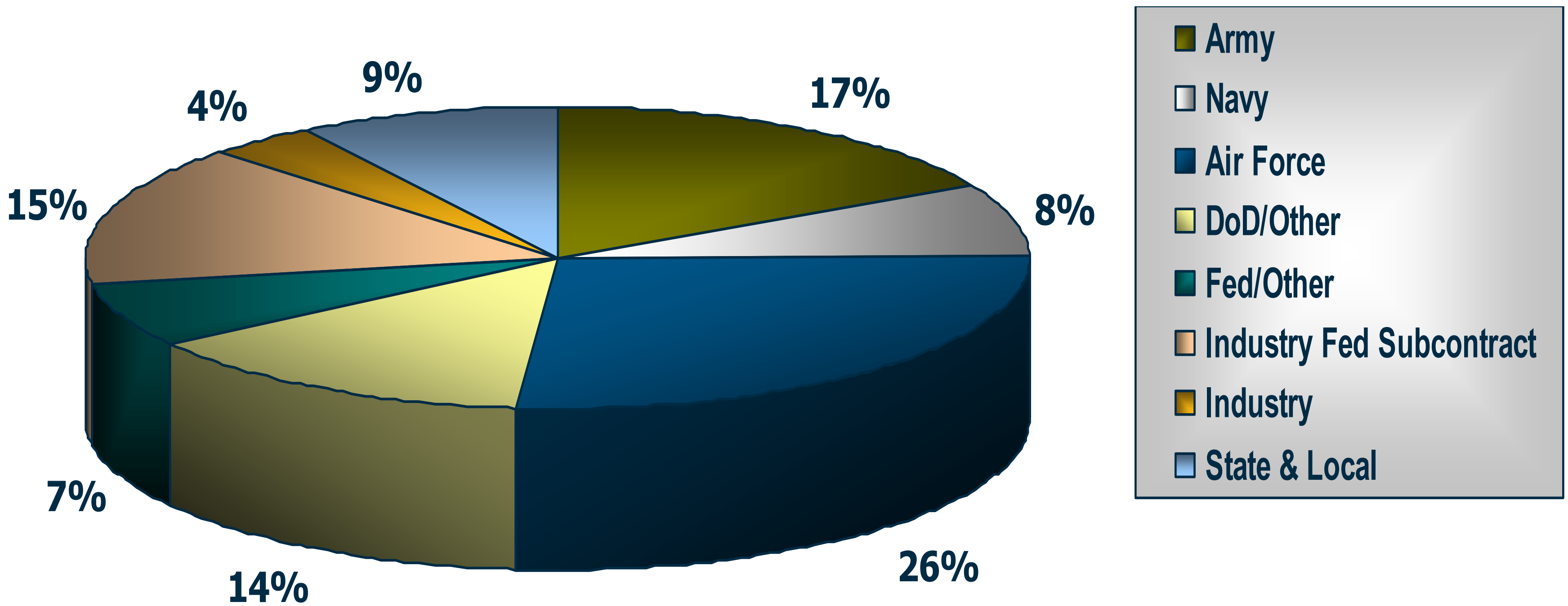
Personnel Statistics

As of October 2005

Research Faculty	552
Research Temp/Retired	94
Classified Professional	29
Classified Regular	238
Support Temp/Retired	126
Students	237
Total	***1,276***

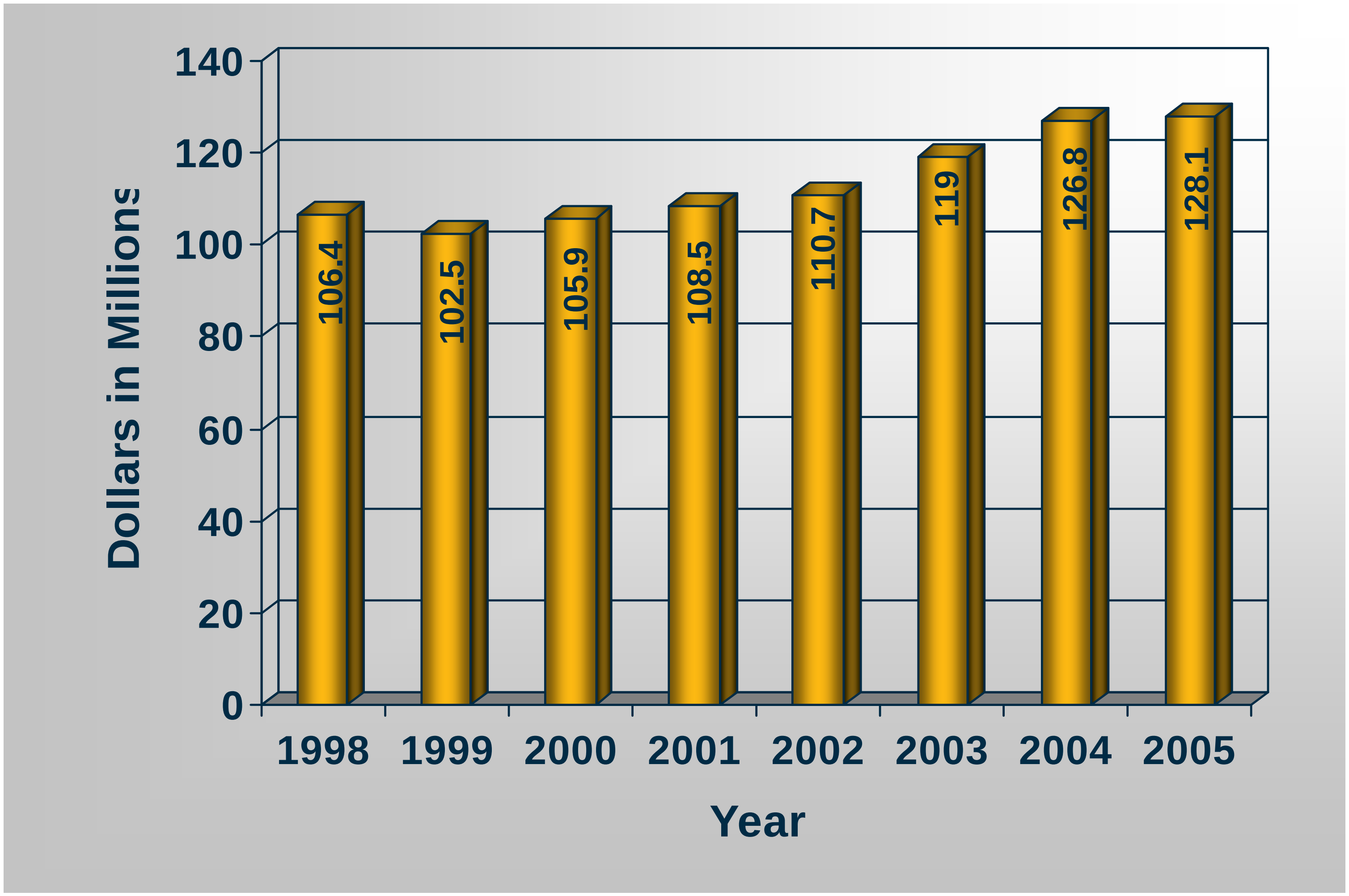
GTRI Financial Statistics

FY05 Major Customers



GTRI Financial Statistics

Historical Volume



Georgia Tech Research Institute

CMM/CMMI at GTRI

- Electronic Systems Lab (ELSYS) CMM Level 3
- Huntsville Lab functioning at CMM Level 4
- Information Technology and Telecommunications Lab (ITTL) has committed to becoming CMMI Level 3
- ELSYS and ITTL working to be jointly assessed on CMMI continuous model in calendar year 2006

Comparison of ELSYS and ITTL

- Independently Managed
- Comparable Size (ELSYS slightly larger)
- Both perform DOD centric work
- ELSYS has greater percentage of work from small number of customers
- ITTL has greater variety of customer types
- ELSYS main customers are requiring CMM/CMMI
- Some ITTL customers also requiring CMM/CMMI, but many others are not

CMM/CMMI at ELSYS

- Multi – Year Effort
- Costs shared with GTRI
- Intended to be basis for other labs becoming certifed
- Certified CMM Level 3 in 2003
- Processes defined by Engineering Processes and Procedures Manual (EPPM)
- Tailored for individual projects
- EPPM being modified to address CMMI issues

CMMI Issues at ITTL

- Commitment to certify required to work on some contracts
- Certification necessary to bid on others
- Many of our customers don’t care about CMMI
- Varying levels of motivation for certification

Timeline for Implementation at ITTL

- Prior to 2004
- 2004 to present
- Future

Prior to 2004

- Lab growing, recognized for doing good work
- Most Projects Well Managed
- Specifics of Project Management decided at Project Level

2004 to present

- January 2004 – appointed dedicated QA Manager
- Told to jointly pursue CMMI and ISO certification
- April 2004 – QA Manager recommends only pursuing CMMI certification, approved by lab management
- April – Sep 2004 implementation plans developed
- September 2004 – Lab Director announces plan to pursue certification to laboratory

2004 to present (cont)

- Sep 2004 - Initial implementation efforts
- Joint Management Steering Group with ELSYS
- Level of support at project level mixed
- Strong support at management level
- Projects had not budgeted for this effort in current projects

2004 to Present (cont)

- Projects expected to have
  - Project Plan
  - Written Requirements
  - Written Design
  - Kept current
  - Controlled Changes
  - Budget for Quality in New Bids

2004 to Present (cont)

- EPPM
  - Large Document
  - Evolved over 5+ years at ELSYS
  - Mostly applicable to ITTL projects
  - Too much to implement all at once
  - Some may be overkill on small projects
  - Identified key processes for all projects
  - Tailor as appropriate for individual projects

2004 to Present (cont)

- Inter lab relationships
  - ELSYS providing valuable support and guidance
  - ITTL usually accepting support and guidance
  - MSG meetings very valuable for big picture
  - Generally follow same processes
  - Occasionally we vary on specific implementation details
  - Working jointly to modify EPPM to meet CMMI standards
  - Teamwork benefits overall inter-lab relationship

2004 to Present (cont)

- ITTL QA Department
  - Dedicated QA Manager
  - 3-4 other QA personnel
  - QA people also do project work
  - Not on projects where they do QA

2004 to Present (cont)

- Adopting existing EPPM used by another lab
  - Very valuable – shown to work for similar organization
  - More similarities than differences in work performed
  - Some resistance due to culture of autonomy
  - Much of value of EPPM is not in the EPPM itself – it is in the blood, sweat and tears involved in developing it
  - Overall, having EPPM to adopt is quite valuable, but it doesn't remove the need to learn from our own mistakes – there is value in the journey

2004 to Present (cont)

- Support for CMMI processes within lab
  - Initially quite varied
  - Frank and open exchange of ideas
  - Management support essential
  - Many with high level of resistance now supportive
  - Still some that are not

2004 to present (cont)

- Northrop Grumman external audit
  - October 2005
  - Done on JMPS program for their SAM process
  - 19 point checklist
  - Overall feedback very positive
  - 3 comments
  - Asked for one supplemental document
  - Not a real audit – we have a long way to go

2004 to present (cont)

- Lessons (being) learned
  - It will take longer than you think
  - Very valuable to be helped by successful group
  - Also value in learning from your own mistakes
  - Management support and commitment essential
  - People will back you if you can show value

Future

- Work with ELSYS to modify EPPM
- Joint assessment 2006 (Continuous Model, hope to show at least Level 2 on all KPAs)
- Joint assessment 2008 (Continuous Model, hope to show at least Level 3 on all KPAs)
- Continuous Improvement

- Questions/Comments???
- scott.sherrill@gtri.gatech.edu
- (404)894-1190 (until ~Feb2006)

CMMI - ISO

“Can’t we all just get along?”

Dale R. Spaulding, CSQE
The Boeing Company

Introduction

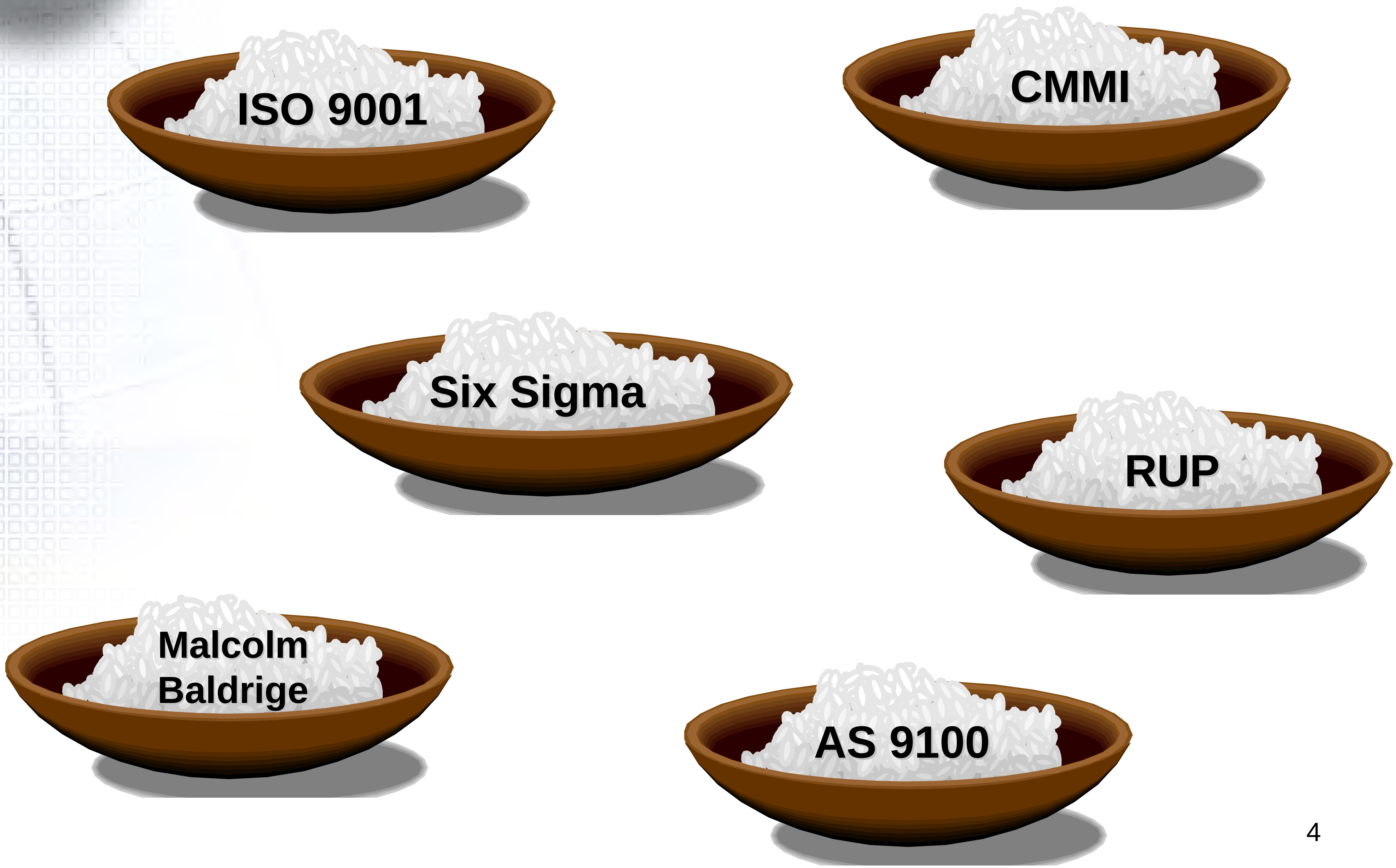
- There are many process improvement initiatives that draw the attention and resources of senior management and the Systems Engineering Process Group (SEPG)

- Organizations that have a process legacy or heritage in a particular model or standard have unintentionally created “Rice Bowls”

Purpose

- This presentation will describe the journey of a Boeing CMM (SW) Level 3 business unit that was merged with a Boeing ISO 9001:2000 registered site and how the resultant organization <u>shattered</u> these Rice Bowls on the road to CMMI (SE/SW) Level 3

The Initiatives - “Rice Bowls”



Setting the Stage @ Boeing

- Task: Integration of two Boeing business units:
  - Business Unit A: CMM (SW) Level 3
  - Business Unit B: ISO 9001:2000 Registered
- Goal: Unified process infrastructure compliant to CMMI (SE/SW) Level 3 and ISO 9001:2000

Initially - Rice Bowls Threatened

Initial Challenges

- ISO and CMMI have different architectures, different languages and different appraisal methods
- Need to set real business goals/objectives for process improvement and try to steer away from goals like:

  "Achieve CMMI Level X" or "Get ISO Registered"

- Reason: Organizations tend to revert back to their old bad habits after achieving CMMI or ISO resulting in the return of cost/schedule overruns and poor quality

Process Action Team (PAT)

- Step 1: “Get over it!”
- PAT Mission:
  - Select the “best practices” from the CMM (SW) and ISO process infrastructures and <u>merge systems together</u>
  - Ensure compliance with both CMMI and ISO 9001:2000
- Terminology Issues: “I’m a CMM guy and this ISO lingo is like a foreign language to me.”
- <u>Key</u>: Think “common process” not CMMI or ISO
- Results: Rice Bowls begin to shatter

Strengths of CMMI and ISO

- CMMI
  - Detailed Engineering practices
  - Comprehensive Program Management practices
  - Concept of increasing "Maturity Levels"

- ISO 9001:2000
  - Spotlight on Customer Satisfaction
  - Focus on Control of Records
  - Ensures process discipline across entire organization
  - Annual Surveillance Audit

PAT Focus - Our Customers

- What do our <u>internal</u> customers want?
  - Simple to use Process Asset Library (PAL)
  - One stop shopping for process, forms, work instructions, templates and samples
  - Not to deal with the ISO/CMMI requirements
  - An “Integrated Process”

Compliance Trace Matrix

ISO 9001:2000 Description		CMMI PA	CMMI Practices	CMMI Description	ISO Implementation	CMMI Implementation
4	**Quality Management System**				GAPS in green	GAPS in red
4.1	**General requirements**					
	Establish and implement the quality management system				Quality Manual & BMS	Quality Assurance Plan
	Identify the processes that comprise the quality management system and determine their relationships				Quality Man. sect. 4.0	Organization Standard Process (OSP)
	Ensure that required resources are available				Quality Man. sect. 6.1	Policy
	Monitor and analyze process performance to ensure that the processes are effective				Quality Man. sect. 8.2	Quality Assurance Plan
	Improve process performance.				Quality Man. sect. 8.5	Quality Assurance Plan
		Generic Goals & Practices	GP 2.1	Establish an Organizational Policy	Quality Man. sect. 5.3	Policy
				Establish and maintain an organizational policy for planning and performing the process.	Quality Man. sect. 5.3	Policy
			GP 2.2	Plan the Process	Quality Man. sect. 4.0	Organization Standard Process (OSP)
				Establish and maintain the requirements and objectives, and plans for performing the process.	Quality Man. sect. 4.0	Organization Standard Process (OSP)
			GP 2.3	Provide Resources	Quality Man. sect. 6.1	Policy
				Provide adequate resources for performing the process, developing the work products and providing the services of the process.	Quality Man. sect. 6.1	Policy

Best Practice – Process Look & Feel

PI 202 QMP –INTEGRATION TEST

BOEING

PURPOSE: The purpose of this process is for the testing of the "integrated" product (hardware, software and interfaces) received from the PI 201 Product Integration process. An Integration test plan/strategy is selected and defects are captured and corrected during the testing activity. When the Integration Test is complete, Configuration Management (CM) takes control of the product baseline in preparation for the System and Beta Test phases.

RESPONSIBILITY

Project Manager (PM): The PM is overall responsible for the planning, scheduling, and budgeting associated with integration testing.

Integration Lead: The Integration Lead will develop and execute the Integration Test Plan per the project's Systems Development Plan (SDP). The Integration Lead develops the integration strategy, acquires the necessary module stubs and drivers, oversees the integration test, records defect data and analyzes results.

Configuration Management (CM): The CM lead is responsible for the receiving the final product from the integration phase and performing the initial build and taking CM control of the baseline at the conclusion of the integration phase.

TOOLS

- CM Tool
- Defect Tracking DB
- MS Word
- MS Project

METRICS

- Test Progress
- Defect History

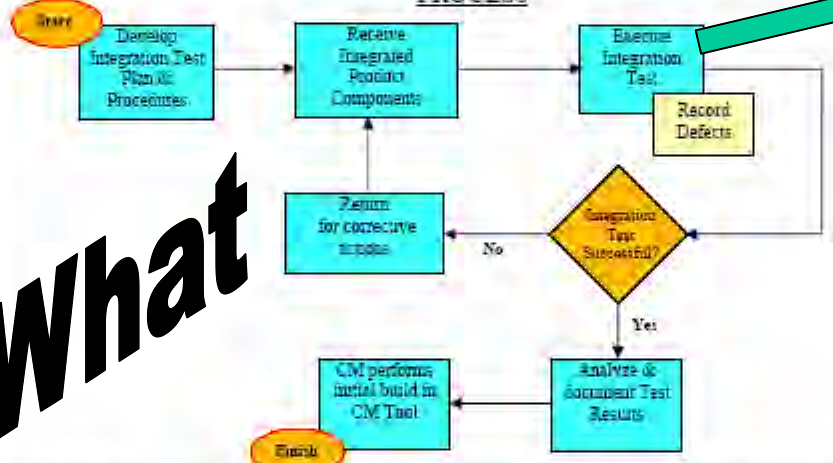
ENTRY CRITERIA

- PI 201 (Product Integration) process complete

EXIT CRITERIA

- Integration Test Report generated
- Product under CM Control

PROCESS



What

INPUTS

- Assembled Product (hardware, software, interfaces)

OUTPUTS

- CM Baseline
- Integration Test Plan
- Integration Test Report

SUPPORTING DOCUMENTATION

- System Specification
- Interface Control Document (ICD)
- Software Design Document (SDD)

WORK INSTRUCTION
PI 202 QMI – INTEGRATION TEST

BOEING

1. **Develop Integration Test Plan and Procedures**
   a) Project manager appoints an Integration Lead to oversee the integration phase efforts.
   b) Integration Lead develops the Integration Test Plan and procedures. The formality of the Integration Test Plan and procedures is project dependent. Smaller projects may develop an informal (internal use only) Integration Test plan and procedures. In this case the Integration Test plan may be included in the overall project Test Plan that includes System and Beta testing. Larger projects develop a formal (separate) Integration Test Plan and procedures that may be a required contract deliverable item.
   c) For either approach described in b) above, the Test Plan Template located on the Process Asset Library (PAL) can be used.

2. **Receive Integrated Product Components**
   a) Integration Lead meets with Project Technical Lead to prepare to receive the integrated product components for the Integration Test.
      - Software: Generally binaries from the development platform will be copied over to the integration platform and the Integration Lead will then control the baseline throughout the Product Integration Phase.
      - Hardware: The hardware or environment necessary for the Integration Test will be established during the PI 201 Product Integration process.

3. **Execute Integration Test**
   a) Integration Lead assembles a test team and oversees integration testing of the product on the integration platform.
   b) Each defect or action item is entered into a defect tracking system and assigned one of the following severity codes by the Integration Lead: (NOTE: the locally developed Defect Tracking Database can be used for this process – see the SE[...]t a copy of this database):
      Code 1: Must be fixed prior to System Test (i.e. Factory Acc[...]e Test)
      Code 2: Must be fixed prior to product rele[...]e
      Code 3: Consider for future release
   c) The entire project team has access to the Integra[...]se. The technical lead will assign developers to the correct defects in t[...]e focusing efforts on problems assigned Code 1 or 2. Corrective actio[...]s documented in the database and following unit testing, the binaries are again [...]orted to the integration platform as discussed in step 2 above. Note: Caution should be taken that corrective actions are limited to defect fixes and NOT new added functionality at this point in the lifecycle. Requirements or functionality changes need to be addressed by management (e.g. Configuration Control Board (CCB)).
   d) The Integration Lead calls integration test status meetings as required to discuss opened/closed defects in the database. This iterative process continues until the integration test phase is successfully completed.

How To

Key Documentation Merge

- Three Key Top Level Legacy Documents:
  - CMM required Policy
  - CMM required Organization Standard Process (OSP)
  - ISO required Quality Manual

- Documentation Merge:
  - All 3 merged into a new Quality Manual
  - Quality Manual format was streamlined to reflect current organization policy/practice and NOT mirror the ISO or CMMI

Our Journey to CMMI Level 3

- Following PAT team's efforts, we:
  - Chartered and staffed a new SEPG
  - Deployed updated process infrastructure
  - Deployed Process Training (web or instructor-based)
  - Conducted CMMI Level 3 Class C
  - Conducted ISO Registration Audit @ legacy CMM site
  - Conducted CMMI Level 3 Class B
  - Three Progress Reviews with External Lead Assessor
  - Conducted CMMI Level 3 Class A SCAMPI Appraisal

Top Ten Lessons Learned

1. Early involvement and frequent visits (Progress Reviews) with external CMMI Lead Assessor
2. Open (constant) communications with ISO Registrar
3. Senior Management involvement and commitment
4. QA “Mentoring” before “Auditing”
5. Processes that reflect “Reality” not “Theory”
6. Proactive/Passionate SEPG Members
7. Regular All Hands Communications
8. Resources ($$ and Instructors) for Process Training
9. Viable Process Improvement Request (PIR) system
10. Frequently Asked Questions (FAQ) email to raise awareness

Sample FAQ

*The following bi-monthly Frequently Asked Question (FAQ) is being provided by the S&IS Mission Systems Quality Department regarding our Quality Management System (QMS) process infrastructure. To see historical FAQs, visit the **Quality Management Homepage** and select the FAQ tab.*

Q: I've just started on a brand new project. With regards to establishing my required Engineering and Project Management documentation, where do I begin?

A: The best place to begin is with the **PP 200 Project Start-up** process. This process starts with a review of our policy contained in the S&IS Mission Systems **Quality Manual** and then helps you develop the following key project documentation found on our **Templates Page**.

- Project Plan
- System Development Plan (SDP)
- Risk Management Plan
- Configuration Management Plan

Additionally, project startup assists with establishing schedules, budgets, tools and metrics on your new project.

Process Improvement Request (PIR)

Process Improvement Request (PIR)

Date: 09/06/2005

Submitted by: **Project Name:**

PIR Title:

(Check most appropriate choice)
- ○ Organization Artifact Improvement
- ○ Project Artifact Improvement
- ○ New Process Submittal

(Classification)
- ○ Emergency - Mission Critical or Safety Issue (request action w/i 2 days)
- ○ Priority - Immediate Project Need (request action w/i 10 days)
- ○ Routine - All Others (request action within 20 days)

Name of Affected Plan, Process, Checklist or other Artifact:

Justification for Emergency or Priority classification:

Improvement Description:

Estimated Benefit of Change (Completed by Submitter)**:**

Sample of Recent PIRs:

- Create Lessons Learned Database
- Online web-based Peer Review Forms
- Add "Operations" field for Defect data collection

What's Next?

- ISO is helping to pave the way for Integrated Product and Process Development (IPPD)
- Functional Organizations (Contracts, Finance, Security, Human Resources, etc) have documented processes under ISO Registration
- <u>IPPD Effort</u>: Create the "hooks" with the Project Management and System Engineering processes

CMMI – ISO: The Bottom Line

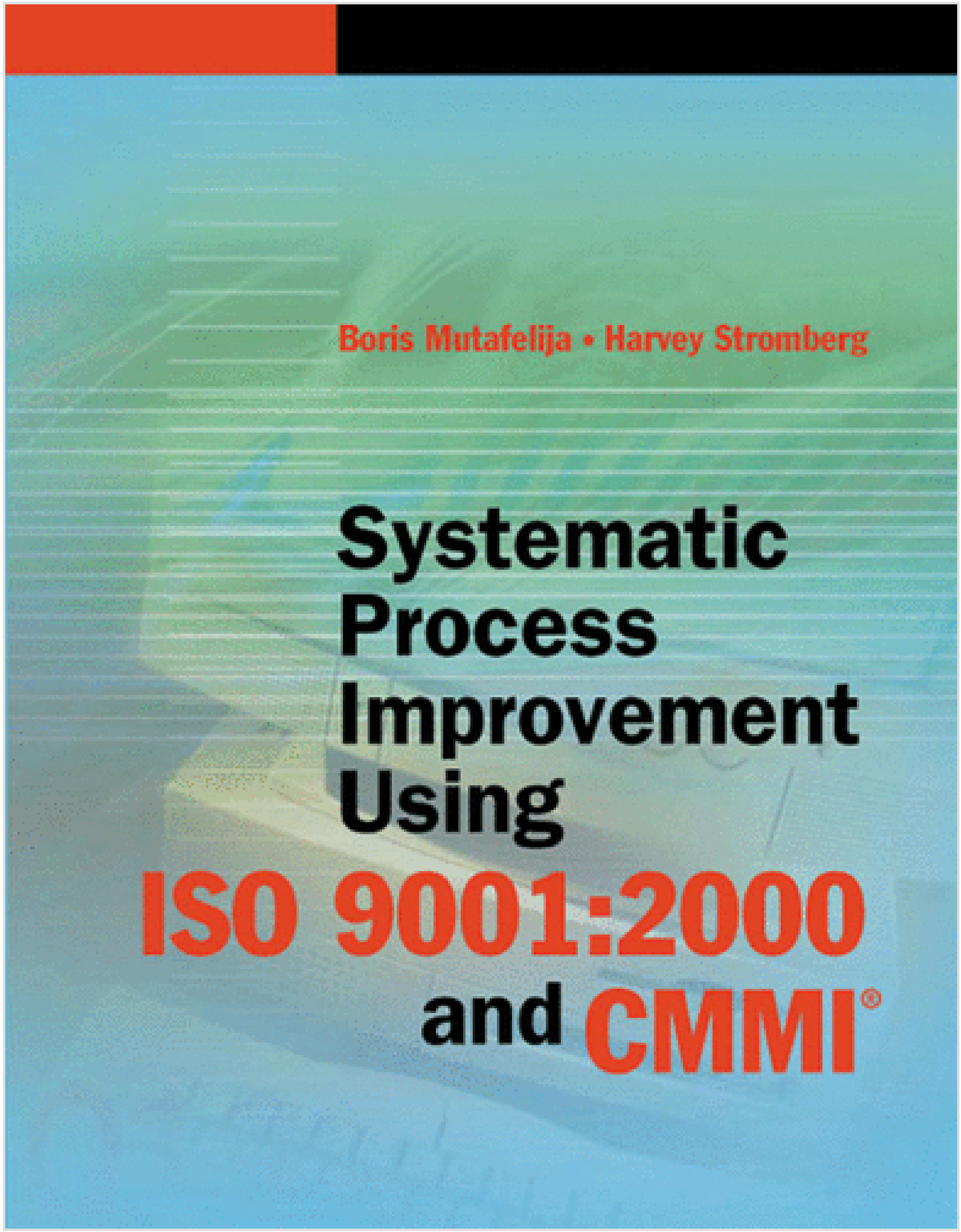
- ISO standard is broader in scope and ensures process discipline across the entire organization
- CMMI model provides greater detail and focus in Engineering and Program Management
- Together, ISO and CMMI models complement each other very well

Q: Can't We All Just Get Along?

A: Yes, We Can and We Did!

QA “Mentoring” before “Auditing”

Recommended Reference



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Making Process and Product Quality Assurance (PPQA) Work on Small Projects

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Electronic Systems Laboratory
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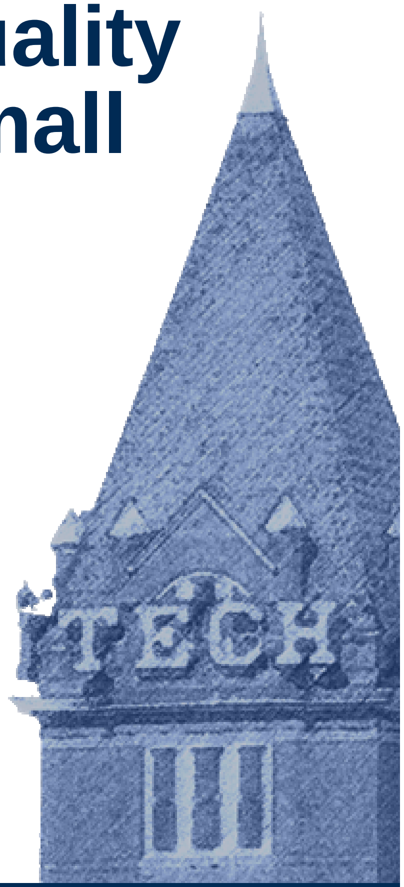
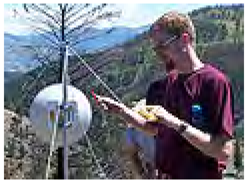
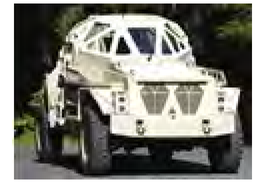


Georgia Institute of Technology



Who is GTRI?



- Unit of the Georgia Institute of Technology
- 1200+ employees
- Wide variety of products
- Customers include federal, state, and industry
- Projects range greatly in size and duration
- More Info:http://www.gtri.gatech.edu/

Georgia Tech Research Institute

Current Status

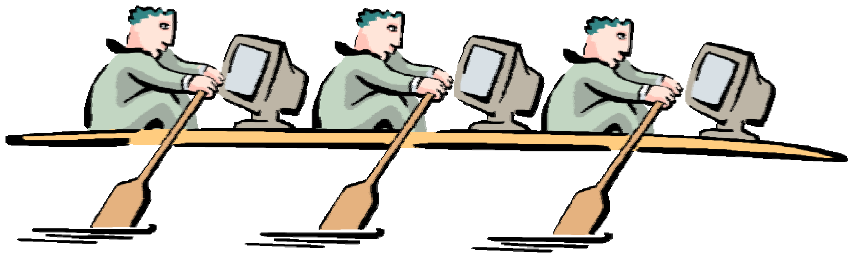
- Assessed CMM level 3
- Performed gap analysis between CMM and CMMI
- Updating processes
- Implementing the new processes
- Not assessed under CMMI

What is PPQA?

- Objectively evaluate performed processes, work products, and services against the applicable process descriptions, standards, and procedures
- Identify and document noncompliance issues
- Provide feedback to project staff and managers on the results of quality assurance (QA) activities
- Ensure that noncompliance issues are addressed

Small Project Assumptions

- A small project has 25 people or less
- Project team generally works together on all phases of product development
- Must trade-off limited resources
- Testers are often the developers



- Need independent inspection at critical phases
- Quality engineers must have technical expertise to add value on a small project

Very Small Projects (5 or less)

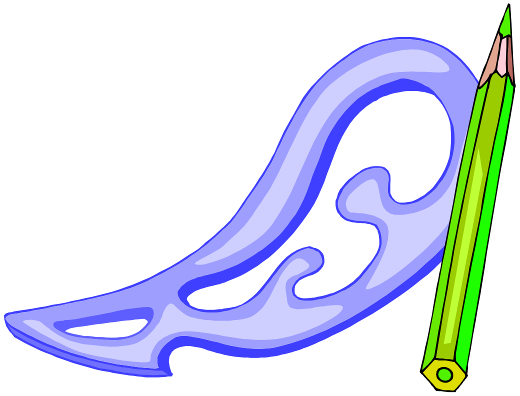
- May not have adequate funding to support even minimal QA activities
- Probably need more outside guidance and independent reviews (QA)

Outline

- Develop a generic PPQA plan
- Hire and/or recruit Quality Engineers highly qualified in the product development field
- Mentor project team
- Analyze project and product risks
- Build a strong base for quality
- Add value by reducing risk

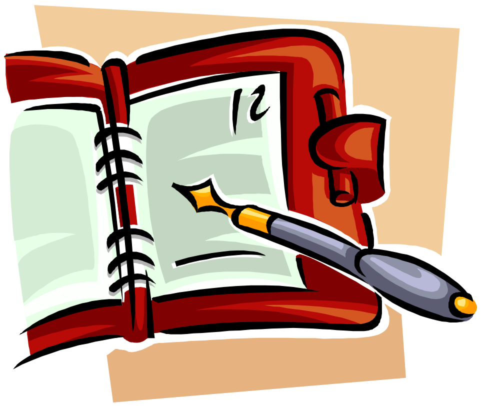
Develop a Generic QA Plan

- Developing a QA plan from scratch for each project is too expensive
- Many QA activities are similar between projects
- Tailoring a generic QA plan and schedule is cost-effective, and is based on:
  - Risk
  - Project team experience
  - Customer requirements
  - Project schedule
  - Project deliverables/milestones



QA Plan Guideline

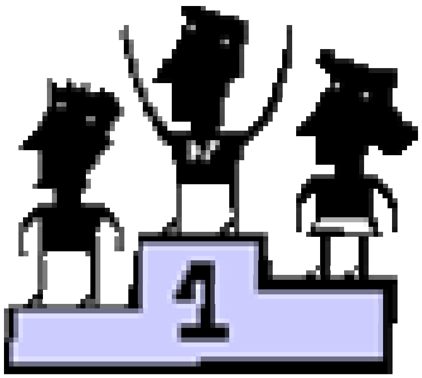
- Tasks
  - Start-Up Tasks
  - Periodic Reviews of QA Activities with all levels of organization
  - Mentor Project Team
  - Support Customer QA
  - Resolve Disputes



- Standards, Practices, and Conventions
- Reviews and Audits
  - List of required reviews (each phase)
  - List of required audits (each phase, deliverables)
  - Peer review guidelines
- QA Schedule Template

Hire/Recruit Qualified – Quality Engineers

- Technical and managerial experience
- Knowledgeable in appropriate technical areas
- Should be capable of doing “real work”
- Recognized by project team for their experience and competency



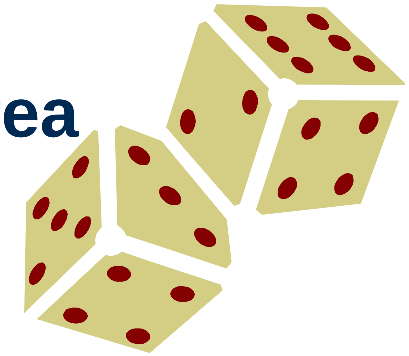
- Able to abstract and share information across projects

Mentor Project Team

- Technical areas
- Management areas
- New processes
- Existing tools and processes
- Attitude

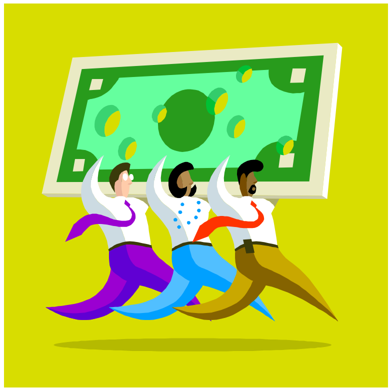
Analyze Project and Product Risks

- Specific team members
  - Compliant vs. noncompliant
  - Experienced vs. inexperienced
- Phases of development
- Cost of re-work or failure
- Familiarity with the subject area



Build a Strong Base for Quality

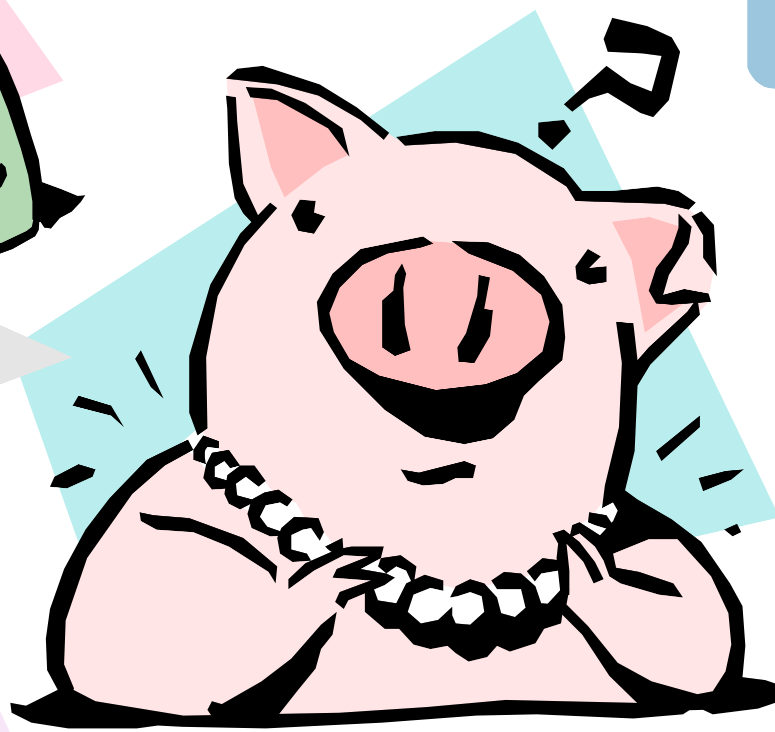
- Leverage “star players”
  - spread across project teams
  - use to develop processes
- Praise “star players” and reward them to the extent that you are capable
- Modify processes to the organization's best-in-class
- Create an environment where process compliance is institutionalized



Add Value by Reducing Risk

- Prioritize organizational QA activities based on project/product risk
- Communicate status to all levels of the organization, as appropriate
- Share lessons learned for all projects
- Assist the project team in developing and implementing risk mitigation strategies
- Act as “the conscience” of the project team

Questions?



Making Process and Product Quality Assurance (PPQA) Work on Small Projects

5TH ANNUAL CMMI TECHNOLOGY CONFERENCE AND USER GROUP

NOVEMBER 15, 2005

ELECTRONIC SYSTEMS LABORATORY

Georgia Tech Research Institute

Georgia Institute of Technology

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Making Process and Product Quality Assurance (PPQA) Work on Small Projects

AUTHORS: JEAN SWANK, JEANNE BALSAM, LEE SHEINER, AND MARK PELLEGRINI

INTRODUCTION

Georgia Tech Research Institute (GTRI) is the nonprofit applied research arm of the Georgia Institute of Technology in Atlanta, Georgia. The Electronic Systems Laboratory (ELSYS) of the GTRI achieved a CMM Level 3 rating in June of 2003. ELSYS employs approximately 150 engineers and scientists working predominately on DoD related competitively bid contracts. Over the last 30 years, ELSYS researchers have established national reputations in areas such as: monopulse countermeasures, advanced radar warning receiver design, survivability, simulation models and analysis, and Electronic Counter Measures (ECM) technique development. GTRI/ELSYS core competencies include software and systems engineering for electronic warfare and avionics systems, reliability and maintainability upgrades, technology insertion, obsolescence programs, threat analysis, and mission critical software. Many of these projects are staffed by fewer than ten developers; some projects have only one or two.

ELSYS has transitioned the CMM Software Quality Assurance process to the CMMI Process and Product Quality Assurance (PPQA). This presentation will share lessons learned while transitioning to a fully compliant systems engineering PPQA function. The reasons for the following statements will be discussed:

1) Develop a generic QA plan and schedule that can be easily tailored for specific project/product needs.
2) Hire and/or recruit Quality Engineers that have enough experience that management respects their recommendations. These people can supplement technical and managerial expertise of the project team which visibly adds value to the development effort.
3) Have Quality Engineers act as mentors to the project team.
4) Analyze project and product risks to determine the most cost effective PPQA strategy.
5) Leverage project team process maturity for reduction of PPQA tasks and for process improvement. Praise process innovators and reward them to the extent that you are capable.
6) Concentrate PPQA on projects or product development efforts that have high risks; for example safety or technology.

This paper describes a method to implement effective PPQA in small organizations or small projects in order to produce best in class products with limited resources.

SMALL ORGANIZATIONS AND PROJECTS

In the context of this paper, “small organizations” refers to organizations of 150 or fewer people with projects ranging in size from one to twenty-five people. The resources a small organization is able to commit to PPQA are generally severely limited. In these organizations, a Quality Engineer typically cannot be assigned full-time to a single project.

A small organization may lack development phase specialization in its members. The same people who write the requirements may also be the testers. The designers might be the implementers. In very small organizations it may be the same people performing *all* of the development activities from start to finish.

This raises an interesting dilemma. What is more important, minimal quality assurance distributed equally on all projects or more comprehensive quality assurance on some, with others receiving very little? When different teams of people write requirements, design, implement, and test a product, there is a sort of "built-in" protection system. If the group writing the requirements does a poor job, the designers will, hopefully, complain that they have been given requirements that are too vague, or the testers will complain that they are un-testable. Likewise, if the coders are given a poor design, they may alert management that there is a problem. However, when the same people are doing all of the development from start to finish, they can walk down a primrose path, not realizing they have a disaster in the making. It is these projects that need PPQA the most, yet they can afford it the least. This is the challenge of making PPQA work on small projects.

Large organizations may have projects with multiple Quality Engineers assigned full-time to them, but they can still have some projects that are quite small, with limited resources and role-sharing. A large organization may experience minimal impact from the failure on one of its smaller projects, whereas a small organization may well experience severe consequences.

PROCESS AND PRODUCT QUALITY ASSURANCE

According to the Software Engineering Institute, "The purpose of Process and Product Quality Assurance is to provide staff and management with objective insight into processes and associated work products.[1]" For small projects there is one key word in this phrase unique to those projects: objective. Generally, everyone on a very small project has fairly good insight to what is happening on the project; what's missing is an objective set of eyes. On large projects there is inherently some objective oversight from other team members. Regardless of whether the project is large or small, management external to the project should be kept objectively informed of the technical and process status of the project.

PLANNING

Through years of experience, GTRI has determined that having a generic Quality Assurance (QA) Plan for the organization is the most effective both in cost and functionality. Additionally, a generic schedule that includes all tasks required by the organization's standard process is used as the starting point for each project. A database is used to track these schedules and any other supplemental material that is project or product specific. Over time the organization should develop a library of generic schedules for each product development type. The generic QA Plan serves approximately seventy-percent of the projects without revision. The QA Plan may be supplemented to address specific tailored processes, risks, and mitigation strategies.

[1] Mary Beth Chrissis, Mike Konrad, and Sandy Shrum, *CMMI* (Addison Wesley, 2003), 429.

The guidelines shown in Table 1 are provided as an example for developing a generic QA Plan for the organization. In general the QA plan needs to be consistent with plans developed for other purposes. It should include the introductory sections including: Identification, Scope, Document Overview, Referenced Documents, and Organizational Structure. Additionally, it should have standard tasks that parallel those of the organization's standard process.

Table 1

Section Name	Description
➢ Tasks	This section provides an outline with detailed expectations for each type of audit and review that QA will provide oversight and support.
o Perform Start-Up Tasks	These tasks are normally executed a single time, but may be repeated for major contractual changes or for incremental developments where this level of coordination/re-planning is necessary.
▪ Attend Project Initiation Meeting	
▪ Generate QA Plans and Schedules	
▪ Prepare for and Attend the Plan Review Meeting	
▪ Prepare Orientation for and Attend Project Kick-off Meeting	
▪ Attend Customer Meetings	
o Conduct Periodic Reviews of QA Activities	Explicitly define what reviews of QA activities are required. Define what type of data is shared at each level and the minimum frequency of communication.
▪ QA Manager	
▪ Lab Director	
▪ Senior Management	
▪ Project Director	
▪ Project Team	
o Mentor Project Team in Organizational Process Activities	Define general mentoring activities that Quality Engineers will conduct during the life of the project, including the value of those activities.
o Support Customer Quality Management System	Define minimum types of support that will be provided by the Quality Engineer to the customer.
o Resolving Disputes	Define methods for resolving disputes between the Quality Engineer and the project team.
➢ Documentation	Define where additional documentation associated with QA activities will be stored (may be by reference).
➢ Standards, Practices, and Conventions	Define where the official organizational standards, practices, policies, guidelines, and conventions are located.
o Tailoring of Standard Process	Reference tailoring practices for the organization's standard process.
o Monitoring Compliance	Define how compliance will be monitored and how deviations will be processed.
➢ Reviews and Audits	Define who shall conduct reviews and audits and how the respective processes and standards will be used in these reviews.
o Technical Reviews	Reference applicable procedures and standards for conduct of technical reviews. Include the level of detail necessary for each type of review and audit to be conducted. Define how data collected during the reviews will be analyzed and reported.
▪ Conduct Periodic Reviews of Project Activities	
• Configuration Management	
• Software Product Engineering Process	
• Hardware Product Engineering Process	
▪ Peer Reviews	
▪ Technical Audits	
• Collect Measurement Data and Document Deviations	
• Analyze Data and Report Results	
▪ Managerial Reviews	
o Configuration Management	Detail specific processes for configuration management audits.
o Problem reporting and corrective actions	Define how problems are reported and corrective actions are tracked to closure.
o QA Document Identification Conventions	Define document identification conventions for QA artifacts.

QUALITY ENGINEERS

To add the greatest value it is essential that quality engineers be well-qualified in both managerial and technical areas. In GTRI, Quality Engineers are required to have technical degrees in either computer science or engineering, with practical experience in product development including project management. In additional to being familiar with the organization's defined engineering processes, they also need to understand project planning and risk management. They are capable of performing technical and managerial work, although they are assigned to the project as an organizationally independent monitor.

Having the ability to do the actual work makes a Quality Engineer far more valuable than a "box-checker." Certainly, checking-the-boxes along the development path is better than having no independent verification at all, but some problems do not lend themselves to discovery simply by seeing if the proper box has been checked. Technically trained Quality Engineers are more likely to detect trouble on a project (and more quickly) than ones who do not understand the technical aspects of the product whose development processes they are monitoring.

Highly qualified Quality Engineers bolster the capabilities of the project team because they add an independent set of eyes to the project team. They attend meetings, review project documentation, and are aware of what the team is doing. Not only can they help spot problems, they can provide suggestions and advice that are valued, as they are recognized by the team as being qualified to do so. Quality Engineers who participate in multiple projects provide another valuable service – they can share technical information between these projects in a way that someone who is simply checking-the-boxes never could. This can help avoid conflicts between products that share requirements or resources. Often the Quality Engineer can share solutions developed on one project with a different project team that is having similar problems.

MENTORING

Classroom training alone is seldom enough to provide a practice capability. In small organizations typically it is expected that employees will learn through self-study and informal mentoring from other project team members. The Quality Engineer is in a good position to identify developers who are in need of mentoring in order to develop a practice capability with the organization's standards and processes.

ASSESSING QUALITY RISKS

In order to properly apply scarce quality assurance resources to projects, it is first necessary to identify the highest areas of risk. A number of factors need to be considered.

Personnel – Knowledge of the capabilities and work habits of the people on a project team can be valuable in deciding where to allocate resources. If the team members are known to generally conform to the organization's defined processes – with everything else being equal – it would be more effective to allocate quality assurance resources to other project teams that are known to be less process compliant or technically challenged. Quite simply, it makes sense to spend time looking

for process violations among people who have a history of violating the organization's processes. Another personnel factor is the level of technical experience of the team. Inexperienced developers would ordinarily warrant closer inspection than those who are veterans. If the Quality Engineers are well-trained and capable of doing technical work, as the authors contend they should be, they can periodically sample the work and sound a warning if there appears to be a problem. In any case, sufficient and appropriate peer reviews of an inexperienced developers' work should be conducted; proper quality assurance verifies that these reviews are being scheduled and completed.

Development Phases – Ideally, a defined process would be followed throughout the entire lifecycle of every product, including a continuous verification by quality assurance that the product is being built correctly. However, in the absence of enough resources to verify continuously, there are certain key phases of development where the quality of the output needs to be verified; for example, the requirements, design, development, and testing phases. Unquestionably it would be better to have requirements written correctly from the start, but if there is a problem with them, it is better to detect and correct the problem before they are used as the foundation for design rather than afterwards. Likewise, a poor design should be identified and corrected before it is implemented. If the quality assurance budget only permits limited involvement of a Quality Engineer in the product's development, it is better to schedule the time at the critical phases, rather than concentrating in a single phase. A set of rock-solid requirements is a good start, but if the entire quality assurance budget was spent on their development and the project goes astray during design, this is not a good trade-off.

Cost of Failure – Sometimes if a product fails, the cost of failure can exceed the money spent on developing it. For example, it could be a key component of some other much larger product or system whose success is dependent upon the smaller one. Loss of reputation or team morale is also an important consideration. But sometimes a small product is just a small product, and if it fails it doesn't have dire consequences for the organization. If two projects have an equal chance of having problems, but one has far greater consequences to the organization if it fails, it makes sense to put more resources on the one that is more important.

Familiarity with the Subject Area – If the product being developed uses new technologies, is planned for deployment in unfamiliar environments or has problems that the organization has never faced before, it is probably a good candidate for more quality assurance resources than one without these challenges. If it is a new product that is very similar in function and scope to an earlier product, it will pose less risk than an unfamiliar one. However, the experience of the project team needs to be considered. Even if the product is very similar to other ones that the organization has created, if the project team has no direct experience with the similar products the risk may still be high.

ADDRESSING PROJECT RISKS

The job of the quality engineer is to make sure that project risks are assessed and documented. Additionally, quality risks should be factored in when assigning resources. In ELSYS, the project is responsible for funding quality assurance. If the project lacks sufficient funding, then corporate resources may be used to insure sufficient oversight is given to the project. After quality and technical risks have been assessed, the risk mitigation plan should be implemented and monitored.

INSTITUTIONALIZING PROCESSES

In a perfect world there would be no need for quality assurance activities; everyone would be qualified to do their job, they would do it perfectly every time, and everyone would follow the organization's procedures for developing products. The world, unfortunately, isn't perfect. Neither is it completely imperfect, where every developer needs a full-time Quality Engineer sitting next to them watching everything they do. The reality is somewhere in between.

The most effective way to utilize good processes to create outstanding products is to create an environment where the project teams *want* to follow these processes, rather than do it because they are forced to do so. Thus, process improvement for product development is more effective when it comes from the bottom up, rather than from the top down. The people doing the work suffer the consequences of their own mistakes, and they can identify the ones that could have been avoided through better processes. The most motivated of these people will take it upon themselves to tailor or to extend the organization's processes to meet their needs. The Quality Engineer is management's representative "in the trenches," and can identify process improvements that should be more generally distributed. Some of these improvements will be generally applicable within the organization and should be incorporated as changes to the defined processes.

The organization needs to identify "star players" who utilize existing processes and work to improve those processes, and those individuals who may not necessarily improve processes, but comply with them. These people should be praised, rewarded, and encouraged to continue doing so. They become role models for the other developers, encouraging them to be compliant and innovative as well. When the project team is voluntarily and enthusiastically following the organization's processes institutionalization occurs and the need for quality assurance is diminished, reducing the need for those scare resources.

PRACTICAL CONSIDERATIONS

Responsibility for project outcome rests on the project manager's shoulders and those of senior management. As such, quality engineers are responsible for bringing concerns to the attention of the project managers and if necessary, senior management. The quality engineer acts as the conscience of the organization, not the police. Senior management must support the quality engineer with a concrete stance on processes and policies. In order for senior management to give that support they must respect the decisions of the quality engineers. Tailoring of processes should be allowed when it makes sense. Variance should be approved when necessary. Quality of the product should always be the guiding value, not who's in charge. Thus, quality engineers should mentor project team members and listen to their concerns to ensure that the best quality processes are utilized and best quality products are built. Make sure that there is a two-way street for communications.

SUMMARY

Process and Product Quality Assurance is the means by which project team members, as well as management, get insight into the processes used and work products produced during the duration of

a product's development. Small projects by their nature have proportionally more need for PPQA, yet they are often the ones that can least afford it. Clearly, it is important for the resources that are dedicated towards small projects to be used as effectively as possible because the margin for error is lower than for larger projects.

If the personnel who are performing PPQA are technically qualified to do the type of work they are monitoring, they can be far more effective in performing their duties than those who are not. They are more likely to detect problems in the product, and identify them earlier, than someone who does not understand the work they are monitoring.

Planning PPQA activities can take proportionally more time for a smaller project than a larger one, so it is desirable to streamline the planning process as much as possible. The use of generic plans and schedule templates can help reduce the time needed to plan PPQA activities.

When deciding how to allocate scarce PPQA resources to projects, the risks must be evaluated to decide which projects need more of those resources. The technical experience level of the project team members, their history of process compliance, and their familiarity with the specific type of product being developed must all be considered. Each project's potential cost to the organization if it fails must also be considered when determining the level of effort that should be allocated for PPQA.

Personnel who perform PPQA on multiple small projects are in a unique position to facilitate communication if most developers in the organization normally work on a single project at a time. They can help to rapidly spread important technical information between the project teams. They can also help to identify experts on one project team whose expertise might be extremely valuable in solving a problem another team is confronting.

Even in small doses, the presence of PPQA on a project reminds the team that there is a process that they need to follow as they develop their products, and there are certain standards that those products must meet. They become the "little voice" in the minds of the developers and act as the conscience of the team regarding process compliance.

Ensuring the Right Process is Deployed Right:

Synchronizing Process Checkpoints with Business Rhythm

NDIA 5th Annual CMMI® Technology Conference and User Group
November 15, 2005

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Lockheed Martin Corporation

Motivation for this Presentation

- *Process "failures" have been identified as a source of program problems*
  - *By DoD*
  - *By industry, including Lockheed Martin*
- *Using CMMI® requires (at maturity level 3) that processes tailored from the organizational standard process be deployed on programs*
- *However, even in organizations using CMMI®*
  - *The "right" process isn't always deployed*
  - *The process isn't always deployed "right"*

How do we ensure the right process is deployed right?

Agenda

- ***What is the "right" process for a program?***
- ***How do we ensure the process is deployed "right"?***

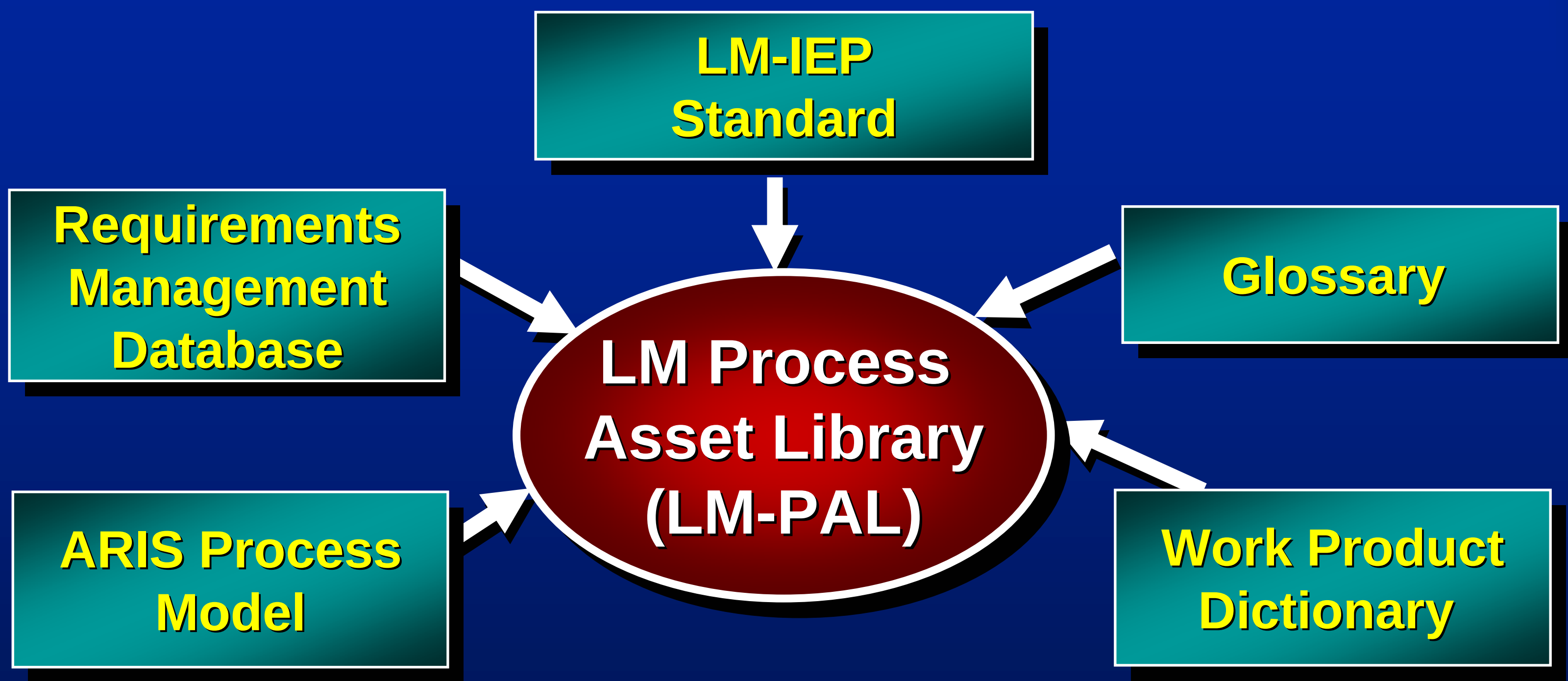
What is the “right” process?

The “right” process

- ***Meets requirements, including standards***
  - ***From the customer***
  - ***From the organization***
- ***Is tailored from the organizational standard process***
- ***Is appropriately suited to the domain and program***
- ***Contains necessary and sufficient process elements***
- ***Is integrated across the disciplines***

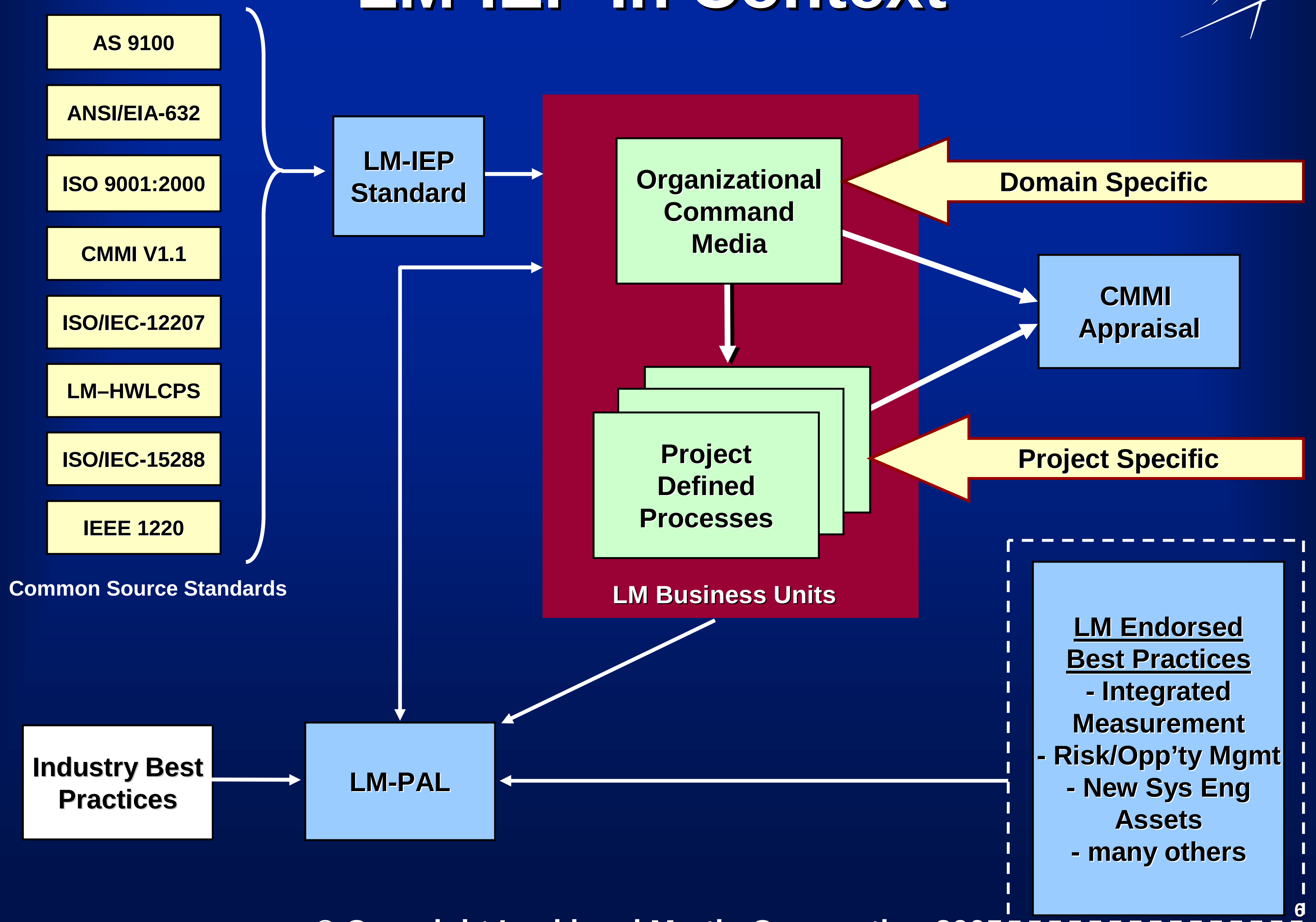
The Lockheed Martin Integrated Enterprise Process (LM-IEP) levies requirements on the Organizational Standard Process

Lockheed Martin Integrated Enterprise Process (LM-IEP) Product Suite



LM-IEP includes Vocabulary, Architecture, Requirements, and Assets

LM-IEP In Context



LM-IEP Architecture

Program Execution Processes

Business Execution Processes

Enterprise Processes

- A.1 Organizational Management
- A.2 Strategic Planning
- A.3 Quality Management
- A.4 Ethics & Business Conduct
- A.5 Legal
- A.6 Communications

Infrastructure Processes

- B.1 Process Management
- B.2 Work Environment Management
- B.3 Technology Mgmt
- B.4 Contracts
- B.5 Workforce Mgmt
- B.6 Finance
- B.7 Supplier Agreements and Procurement
- B.8 Security
- B.9 Property Mgmt

Common Management Processes

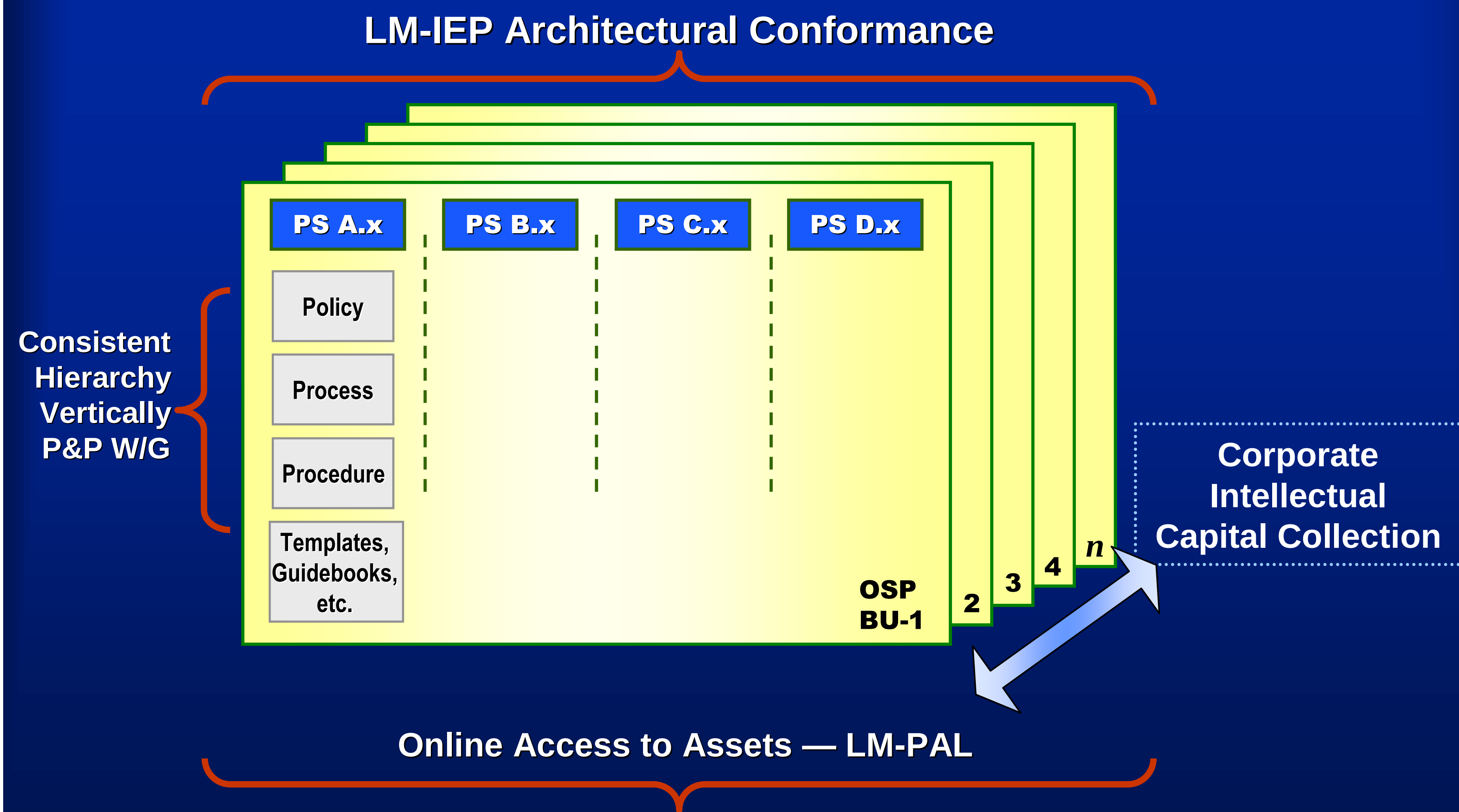
- C.1 Project Planning
- C.2 Decision Analysis
- C.3 Configuration and Data Management
- C.4 Performance Assessment and Control
- C.5 Risk and Opportunity Management

Product Life Cycle Processes

- D.1 Program Mgmt
- D.2 Business Capture
- D.3 Development*
  - D.3.1 Stakeholder Needs Analysis
  - D.3.2 Requirements Development
  - D.3.3 Architectural Design
  - D.3.4 Detailed Design
  - D.3.5 Implementation
  - D.3.6 Integration
  - D.3.7 Verification
  - D.3.8 Validation
- D.4 Production
- D.5 Deployment
- D.6 Operation and Sustainment
- D.7 Disposal

** Recursive processes to be applied at any level of the system hierarchy*

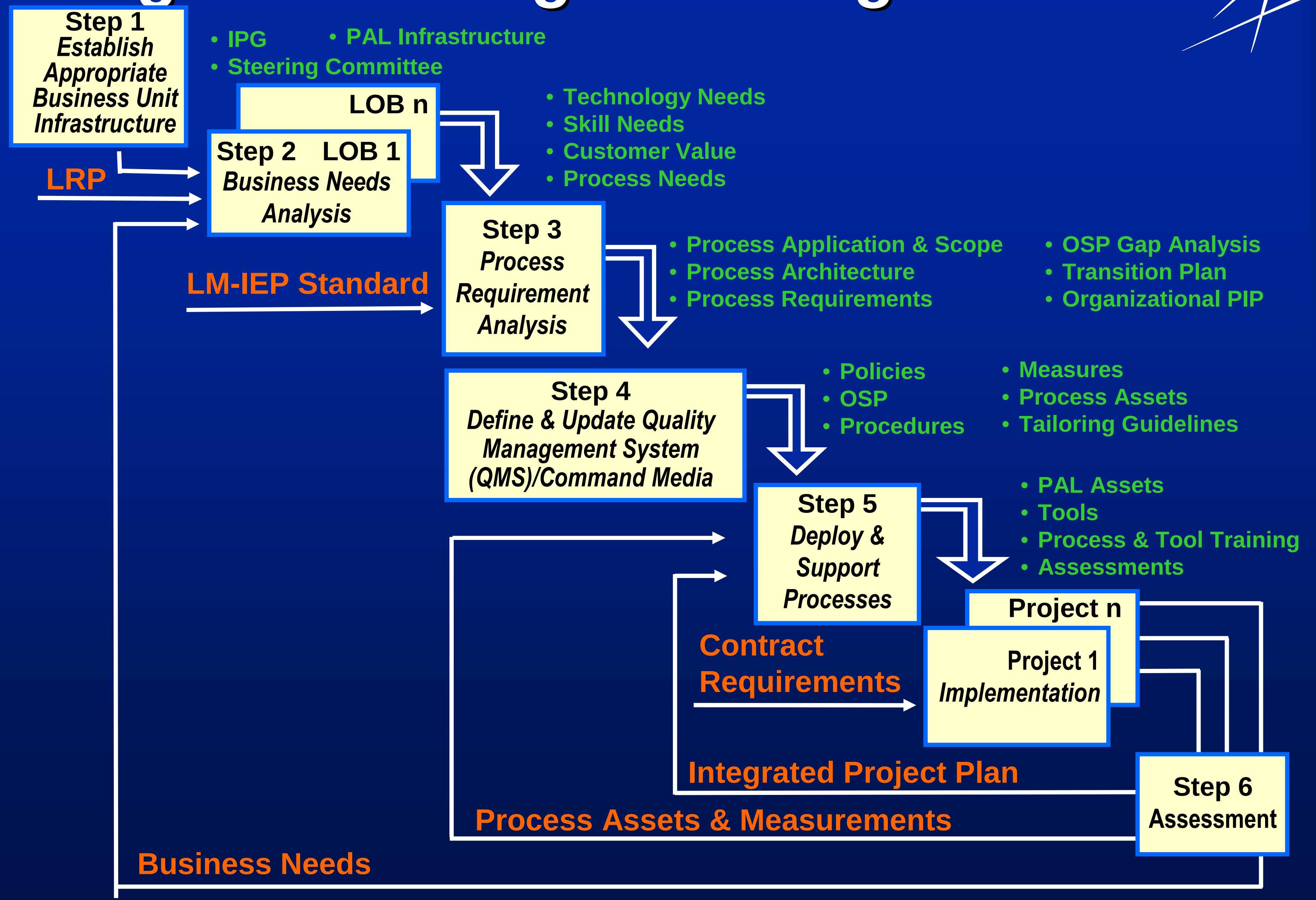
Goal: Consistent OSP Architectures



Key Architectural Tenets

- ***Architecture covers the entire enterprise***
  - To be used as a taxonomy for Corporate command media
  - Detailed taxonomy below IEP level to be determined by responsible functional organizations
- ***Is complete in scope, not in requirements***
  - Requirements based on source standards, thus heavy emphasis on PM, Quality, and Engineering
  - Requirements in other areas need to be augmented by existing corporate policies and procedures, and other industry standards
- ***Represents a single architectural "view"***
  - Presents process elements from a topical viewpoint
  - Other views required for management and practitioners; e.g., temporal, role-based, information flow

Using LM-IEP to get the "right" Process



How do we ensure the process is deployed “right”? - 1

The typical approach involves….

- *Organizational policy (“thou shalt…”)*
- *Process & Product Quality Assurance*
- *Mechanisms for ensuring process fidelity, including*
  - *Process-enforcement mechanisms such as process enactment tools*
  - *Process tailoring approval*
  - *Quality assurance audits*
  - *Reviews, checklists, etc.*

How do we ensure the process is deployed “right”? - 2

- ***Lockheed Martin experience is that ensuring the process is deployed “right” requires***
  - ***Process checkpoints synchronized with a program’s business rhythm***
  - ***Including process improvement investment during strategic, long-range planning***
  - ***Prescribing organizational participation in corporate-level infrastructure***

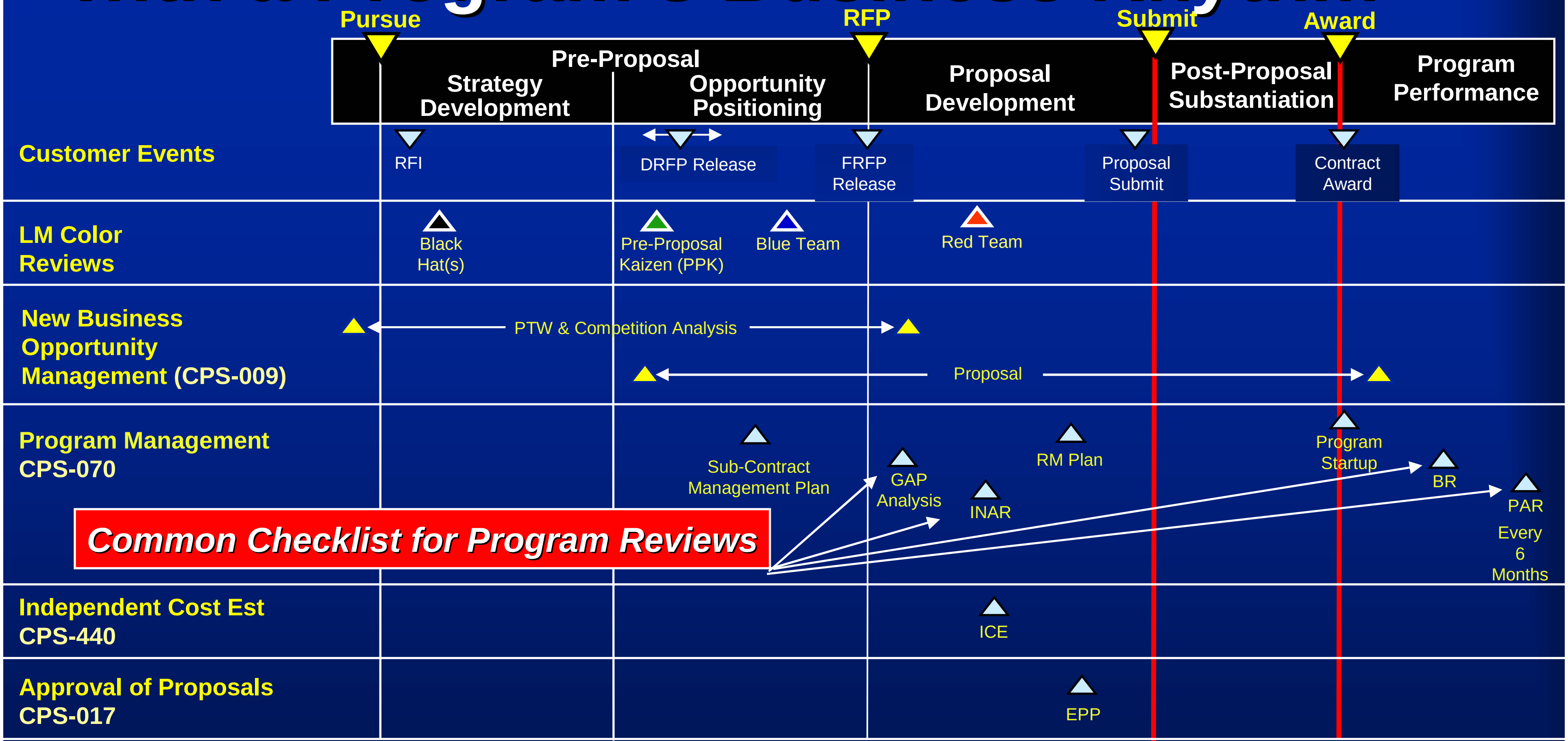
Corporate policy enforces these checkpoints

Corporate Policy Statement (CPS) on *Program Management (PM)*

- ***A: Program Manager Development***
- ***B: Risk Management***
- ***C: Past Performance***
- ***D: Proposal and Program Reviews*** → **Updated**
- ***E: Data Management***
- ***F: Configuration Management***
- ***G: Managing Major Subcontracts***
- ***H: Integrated Planning & Scheduling*** → **New**
- ***I: Program Performance Reporting*** → **New**

Corporate Direction to Formalize the PM Infrastructure

Synchronizing Process Checkpoints with a Program's Business Rhythm



Allows:

- ***On-line Completion and Storage of Checklist***
- ***Centralized Repository for Review Artifacts***
- ***Automatic Action Item Generation***
- ***Summary Metrics of Checklist Findings***

Assuring Organizational and Program Process Compliance & Implementation

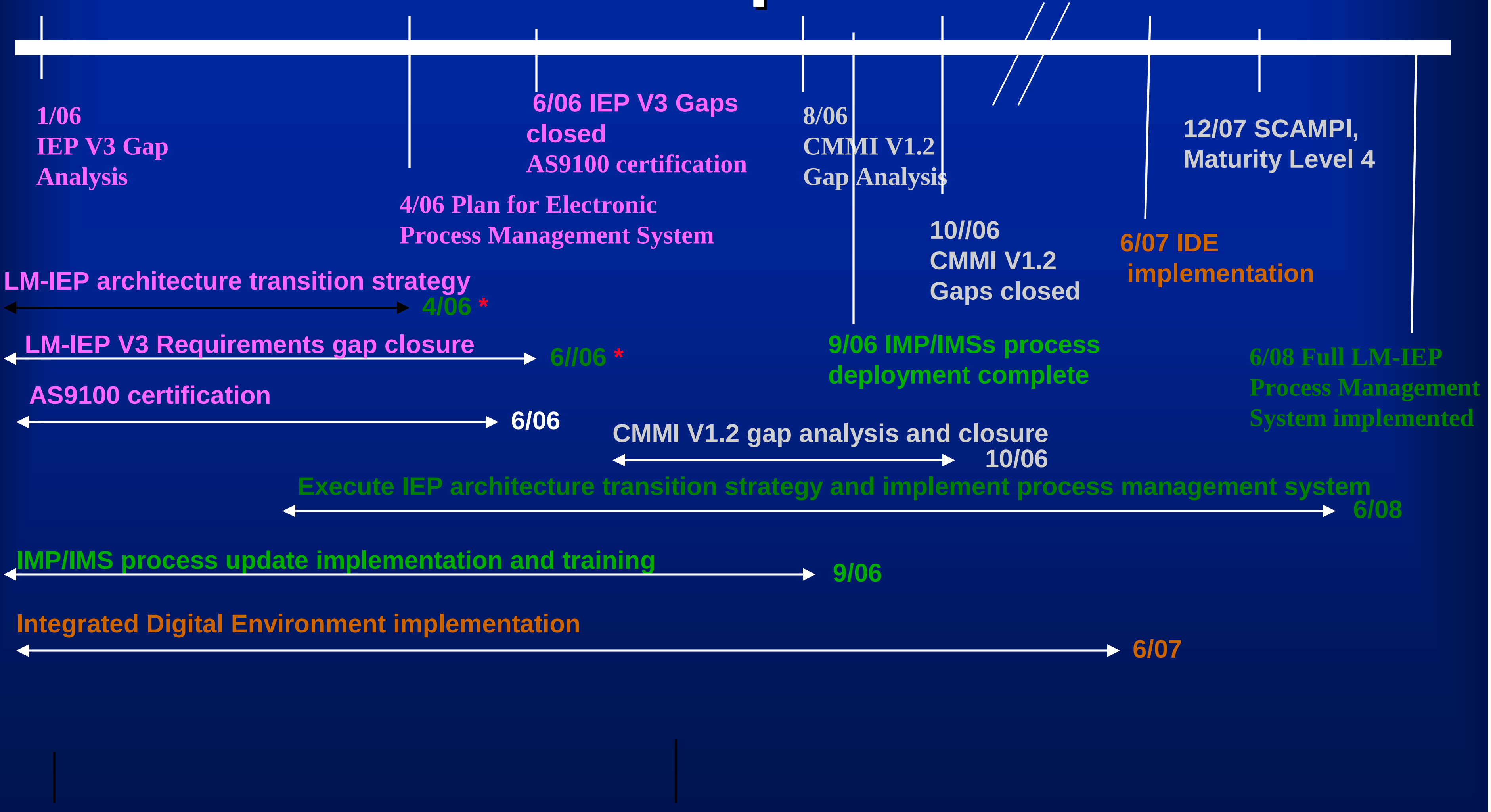
Customer Appraisals		CMMI® SCAMPI B/C	
Contractor Appraisals	CMMI® "SCAMPI Type A"	Internal Checks & Balances	
Command Media	Organization Standard Processes	Tailoring of Processes	Program Processes, Implementation & Management
Program		Proposal	Program Execution

Recommendation: Institute the requirement for process maturity in command media with check and balance for implementation and management.

Future Improvements

- *Fully electronic processes (using models/tools) to*
  - *Improve human understanding and communication*
  - *Improve process fidelity, management and improvement*
  - *Implement multiple views (e.g., behavioral, functional, organizational, informational)*
    - *Support process enactment*
- *Improved program startup*
  - *Ensure smooth transition from proposal phase*
  - *Enable quick and robust program initiation*

Process Improvement Strategy Example



* Submit to corporate

Why participate in corporate infrastructure?

Subcouncil Participation

BRING

issues /
needs
& your assets

TAKE HOME

assets /
solutions

Business Unit Infusion

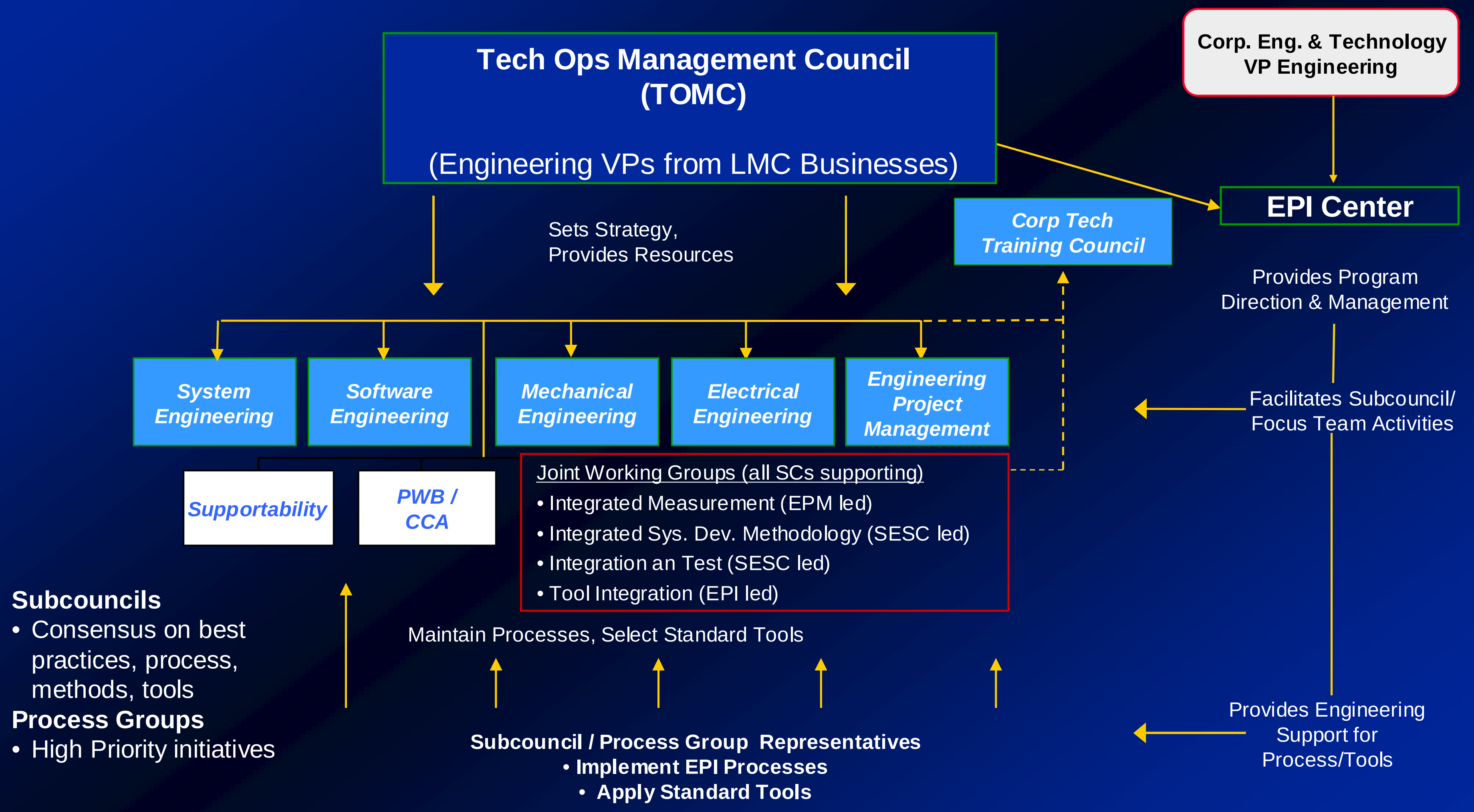
Improve Productivity

Lower Cost to Programs & Business

Implement SC Assets

Connect Local users to help network

EPI Program Infrastructure: 2005



SubCouncil/Process Group Participation Benefits Members, Companies and Lockheed Martin

Summary

- ***Selecting the "right" process for a program is non-trivial and requires***
  - ***Having the "right" OSP***
  - ***Using the "right" assets to support the process***
- ***Supporting infrastructure facilitates deploying the process "right"***
  - ***Process checkpoints linked to program milestones***
  - ***Strategic investment to leverage across businesses***
  - ***Infrastructure support (e.g., participation in corporate-level councils)***

BACKUP

LM-IEP Standard

Defines “what” level of processes versus “how”
- **LM-IEP Standard specifies what is to be performed**
- **Company processes, methods and tools specify how**

PART I
OVERVIEW
- 1. Introduction
- 2. Referenced Documents
- 3. LM-IEP Conformance
- 4. Glossary
- 5. List of Acronyms

PART II
PROCESS SPECIFICATIONS
- Preface
- Process Specifications

PART III
TRACEABILITY TO SOURCE STANDARDS
- LM-IEP To Source Standards
- EIA/ANSI 632 to LM-IEP
- CMMI®-SE/SW/IPPD/SS to LM-IEP
- ISO 9001:2000 to LM-IEP
- ISO/IEC 12207 to LM-IEP
- ISO/IEC 15288 to LM-IEP
- EPI 280-07 to LM-IEP
- IEEE 1220 to LM-IEP
- AS9100 to LM-IEP

PART IV
LM-IEP CONFORMANCE MATRICES
- LM-IEP Requirements Conformance Matrix

Standard (280-01) available on the EPI web-site at http://www.epic.lmco.com/docs/280-01all/index.htm

Capability Maturity Model Integration Technology Conference and User Group

Lieutenant General Joseph L. Yakovac, Jr.
Military Deputy to the
Assistant Secretary of the Army
(Acquisition, Logistics and Technology)

Denver, Colorado
15 November 2005

Future Force Capabilities

"Factory to Foxhole"

"Space to Mud"

- **Future Force Characteristics – Responsive, Deployable, Agile, Versatile, Lethal, Survivable, Sustainable…**
- **A New Way of Joint Warfare**
  - Dominant situation awareness
  - Networked weapons systems
  - Joint Interdependence to Small Unit Level
- **More Strategically Responsive Land Force**
  - Lighter, more air and sea transportable
  - Reduced sustainment footprint/ reachback/3 days combat without re-supply
- **Technology Enabled -** Spiral development/insertions
- **Capabilities Based Force** for combatant commanders now… future!

See First
Understand First
Act First
Finish Decisively

Supports National Security and Military Strategies

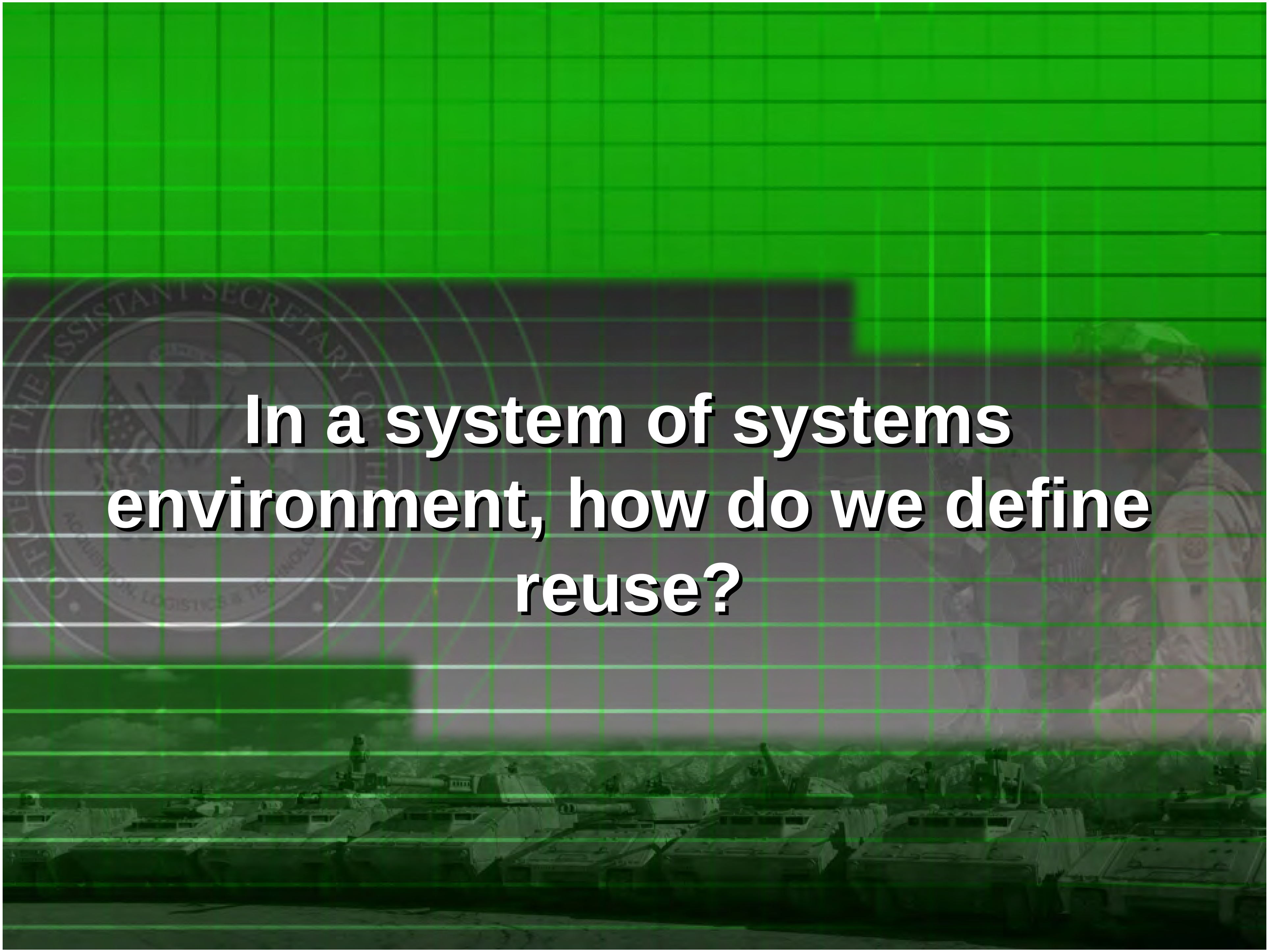
If Capability Maturity Model Integration (CMMI) reduces the costs of systems engineering components, then what is the next step to ensure that system of systems engineering improves cost, schedule, and overall quality?

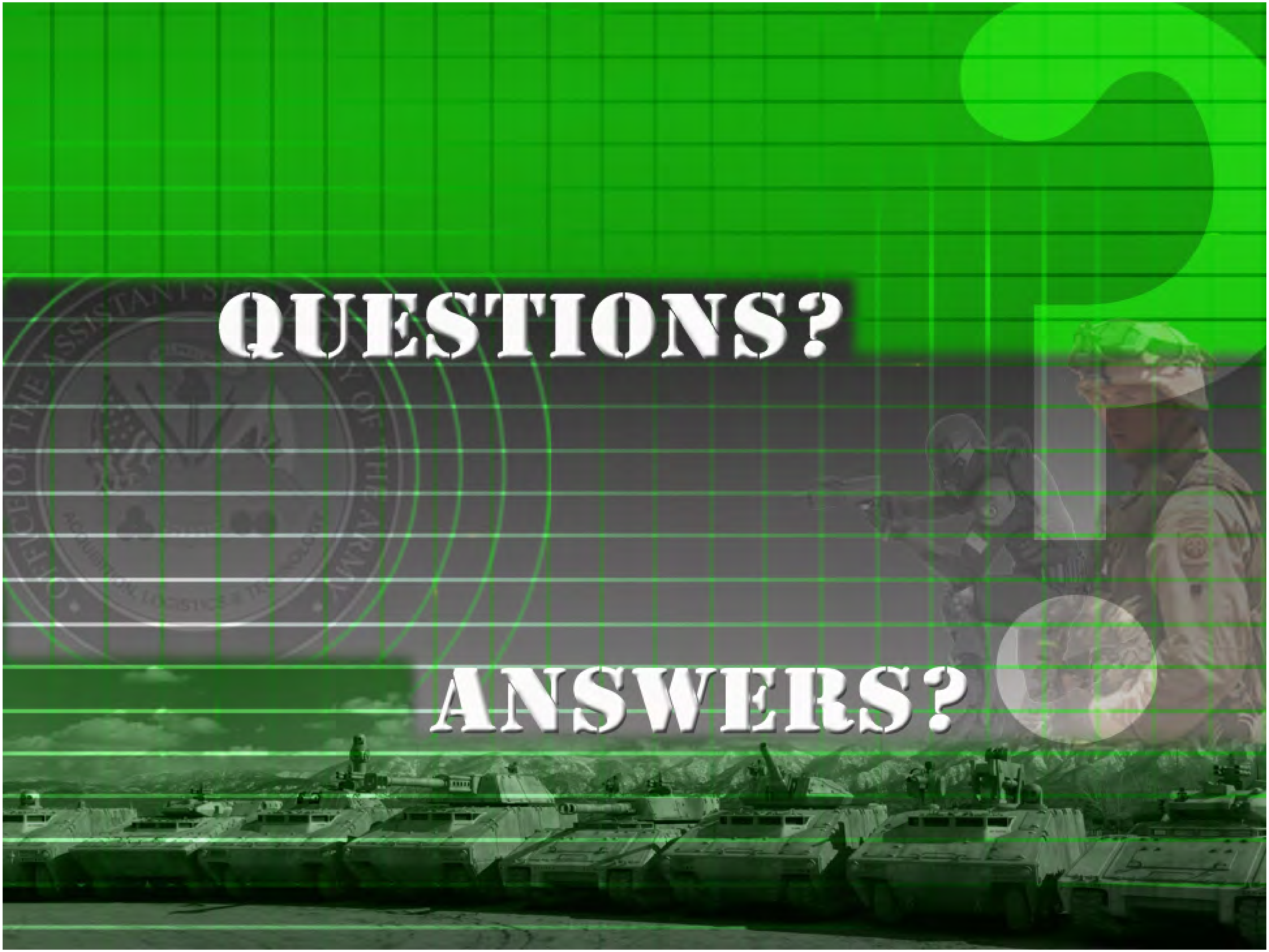
How many here today are systems engineers?

How many here today are software engineers?

How many of the systems engineers or software engineers here today are currently involved in a system of systems project?

How do you assess the CMMI level of a system of systems that brings together a group of users and developers who normally focus on stand alone programs?


In a system of systems environment, how do we define reuse?


QUESTIONS?
ANSWERS?